



NEWARK BAY STUDY AREA

ADDITIONAL SITES AND CANDIDATE PRPS FOR THE NEWARK BAY STUDY AREA

VOLUME III OF IV

PRP DATA EXTRACTION FORM AND EVIDENCE CONCERNING:

**EXXON MOBIL CORPORATION
BAYONNE SITE**

PREPARED BY:
TIERRA SOLUTIONS, INC.

SUBMITTED TO:
USEPA REGION II

MAY 2007

Instructions
Fill in this form. The
information requested here is
for use only (Section 3010
Resource Conservation
and Recovery Act).



Notification of Regulated Waste Activity

United States Environmental Protection Agency

Date Received
(For Official Use Only)

ENVIRONMENTAL PROTECTION
AGENCY REGION II

Installation's EPA ID Number (Mark 'X' in the appropriate box)

☐ A. First Notification ☒ B. Subsequent Notification
(complete item C)

C. Installation's EPA ID Number

N J T 3 5 2 0 0 2 1 4 4

II. Name of Installation (Include company and specific site name)

EXXON COMPANY USA - BAYONNE

III. Location of Installation (Physical address not P.O. Box or Route Number)

Street

1 AVENUE J

Street (continued)

City or Town

BAYONNE

State

ZIP Code

NJ 07002-5077

County Code

County Name

HUDSON

IV. Installation Mailing Address (See Instructions)

Street or P.O. Box

SAME

City or Town

State

ZIP Code

V. Installation Contact (Person to be contacted regarding waste activities at site)

Name (last)

(first)

DeANGELO

PETER

Job Title

Phone Number (area code and number)

PLANT ENGINEER

201-858-6893

VI. Installation Contact Address (See Instructions)

A. Contact Address
Location Mailing

B. Street or P.O. Box

City or Town

State

ZIP Code

VII. Ownership (See Instructions)

A. Name of Installation's Legal Owner

EXXON COMPANY USA

Street, P.O. Box, or Route Number

800 BELL STREET

City or Town

State

ZIP Code

HOUSTON

TX 77002-7426

Phone Number (area code and number)

B. Land Type

C. Owner Type

D. Change of Ownership
Indicator

713-656-7705

P

P

Yes ☐ No ☒

4/8/93 Change of address is due to part of the property being sold to another owner.

1D - For Official Use Only

NJ 7 3 5 0 0 1 1 4 4

VIII. Type of Regulated Waste Activity (Mark 'X' in the appropriate boxes. Refer to Instructions.)

A. Hazardous Waste Activity

1. Generator (See Instructions)
- ☒ a. Greater than 1000 kg/mo (2,200 lbs.)
- ☐ b. 100 to 1000 kg/mo (220 - 2,200 lbs.)
- ☐ c. Less than 100 kg/mo (220 lbs.)
2. Transporter (Indicate Mode in boxes 1-5 below)
- ☐ a. For own waste only
- ☐ b. For commercial purposes
- Mode of Transportation
- ☐ 1. Air
- ☐ 2. Rail
- ☐ 3. Highway
- ☐ 4. Water
- ☐ 5. Other - specify
- ☐ 3. Treater, Storer, Disposer (at installation) Note: A permit is required for this activity; see instructions
4. Hazardous Waste Fuel
- ☐ a. Generator Marketing to Burner
- ☐ b. Other Marketer
- ☐ c. Boiler and/or Industrial Furnace
- ☐ 1. Smelter Refractor
- ☐ 2. Small Quantity Exemption
- Indicate Type of Combustion Device(s)
- ☐ 1. Utility Boiler
- ☐ 2. Industrial Boiler
- ☐ 3. Industrial Furnace
- ☐ 5. Underground Injection Control

B. Used Oil Fuel Activities

1. Off-Specification Used Oil Fuel
- ☐ a. Generator Marketing to Burner
- ☐ b. Other Marketer
- ☐ c. Burner - Indicate device(s) - Type of Combustion Device
- ☐ 1. Utility Boiler
- ☐ 2. Industrial Boiler
- ☐ 3. Industrial Furnace
- ☐ 2. Specification Used Oil Fuel Marketer (or On-site Burner) Who First Claims the Oil Meets the Specification

IX. Description of Regulated Wastes (Use additional sheets if necessary)

A. Characteristics of Nonlisted Hazardous Wastes. Mark 'X' in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles. (See 40 CFR Parts 261.20 - 261.24)

1. Ignitable (D001) ☒ 2. Corrosive (D002) ☒ 3. Reactive (D003) ☒ 4. Toxicity Characteristic (D000) ☒
- (List specific EPA hazardous waste number(s) for the Toxicity characteristic contaminant(s))
- D 0 0 7 D 0 0 8 D 0 1 8

B. Listed Hazardous Wastes. (See 40 CFR 261.31 - 33. See instructions if you need to list more than 12 waste codes.)

1 F 0 0 2	2 F 0 0 3	3 F 0 0 5	4 F 0 2 7	5 U 0 1 2	6 U 2 2 0
7 U 2 3 9	8	9	10	11	12

C. Other Wastes. (State or other wastes requiring a handler to have an I.D. number. See instructions.)

1 X 7 2 1	2 X 7 2 5	3 X 7 2 6	4	5	6
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X. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature

Name and Official Title (type or print)

Date Signed

Christopher P. Kramer / Plant Mgr

4/2/93

XI. Comments

The facility street address has changed from "250 E 22nd Street" to "1 Ave J"

Exxon will continue to use the existing ID Number for the Lubricants Plant and Site Remediation

Note: Mail completed form to the appropriate EPA Regional or State Office. (See Section III of the booklet for addresses.)

EXXON COMPANY, U.S.A.

POST OFFICE BOX 2180 • HOUSTON, TEXAS 77001

SALVATORE J. CASAMASSIMA
ATTORNEY

November 13, 1980

Environmental Protection Agency
EPA Region II
Information Service Center
26 Federal Plaza
New York, New York 10007

NJT350011144

Willie
Doc

Gentlemen:

The enclosed permit application is submitted by Exxon Company, U.S.A. (a division of Exxon Corporation) on behalf of the Exxon Bayonne Plant located within EPA Region II. This application is being submitted in accordance with the requirements of the Resource Conservation and Recovery Act (42 U.S.C. 6901) and applicable hazardous waste and consolidated permit regulations published February 26 and May 19, 1980 by EPA.

Please note that the enclosed permit application containing Forms 1 and 3 has been certified by Mr. R. W. Haddock, Vice President of Refining for Exxon Company, U.S.A. Mr. Haddock has personally examined and familiarized himself with this application and, in my presence, made a direct inquiry of the persons immediately responsible for obtaining the information contained therein in regard to its truthfulness, accuracy and completeness.

The development of the information contained in this permit application submitted by Exxon Company, U.S.A. is the result of the cooperative effort of many individuals. Meetings and workshops were held to review and analyze the Subtitle C regulations, to identify hazardous wastes generated by the Bayonne Plant, and to determine which on-site operations treated, stored, or disposed of hazardous wastes. A comprehensive, good faith effort was made by Exxon Company, U.S.A. to assure the preparation of a truthful, accurate and complete permit application. However, EPA has acknowledged that the hazardous waste regulations published on February 26 and May 19, 1980 have raised numerous questions by the regulated community. In a notice published August 19, 1980 (45 Fed. Reg. 55386), EPA expressed its intention to correct or clarify the hazardous waste regulations by means of technical amendments,

Environmental Protection Agency
Page 2
November 13, 1980

with explanation, or by Regulatory Interpretation Memoranda (RIMs). Issuance of the technical amendments or RIMs was promised for August, September, and October, 1980. Although several technical amendments (final, interim, and proposed) were issued on October 30, 1980, there remained many unresolved questions. Should additional amendments or RIMs be issued after November 7, 1980, they will be too late to allow revisions to the above-referenced permit application which needed to be finalized at our Company headquarters by that date.

EPA has recognized that the answers to certain questions in the permit application will remain uncertain until resolved by the explanations contained in the technical amendments or RIMs. It is therefore requested that EPA allow RCRA permit applications to be revised, without prejudice, following November 19, 1980, provided such revisions are necessitated by those technical amendments or RIMs which issue subsequent to the final preparation and/or filing of a permit application. Failure to allow such revisions would raise serious questions regarding due process and could jeopardize interim status for many facilities. EPA's cooperation in this matter is sincerely requested.

Very truly yours,

Salvatore J. Casamassima

SJC:jvk
Enclosure

ATTACHMENT 2

BAYONNE PLANT LABORATORY WASTES

Small quantities of laboratory wastes listed under Section 261.33 (e) and (f) are periodically and sporadically generated and are disposed of through the sewer system and enter the API Separator where they are treated. Examples of wastes which may appear are:

U-012	Aniline
U-037	Chlorobenzene
U-044	Chloroform
U-070	1,2 - Dichlorobenzene
U-080	Dichloromethane
U-154	Methyl Alcohol
U-220	Toluene
U-227	1,1,2 Trichloroethane
U-239	Xylene

EXXON COMPANY, U.S.A.

1 AVENUE J • BAYONNE, NEW JERSEY 07002-5077

MARKETING DEPARTMENT
LUBRICANTS AND PETROLEUM SPECIALTIES
BAYONNE LUBRICANTS PLANT

C.P. KRAMER
MANAGER

Certified Mail - RR

P 045 013 177

April 2, 1993

Mr. Norman Rost
Program Management Coordinator
USEPA - REGION II
Air & Waste Management Division
26 Federal Plaza, Room 1006
New York, New York 10278

Re: Subsequent Notification of Regulated Waste Activity
EPA ID Number NJT350011144
Exxon's Bayonne Lubricants Plant

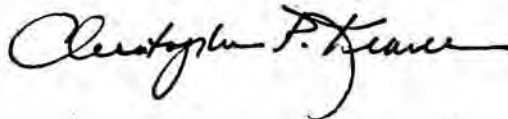
Dear Mr. Rost:

On February 3, 1993, Exxon Corporation ("Exxon") entered into a contract to see its Bayonne Fuels Terminal to International MATEX Tank Terminals ("IMTT-BX"). Closing occurred on April 1, 1993. Exxon will retain ownership of its Lubricants Plant at the site. This letter informs you of changes which are going to take place at our facility (EPA ID Number NJT350011144), as a result of the sale of the Fuels Terminal and Chemical Plant portion of our Bayonne operation to International MATEX Tank Terminals (IMTT). Exxon will continue to utilize its existing EPA ID Number for the Lubricants operation, as well as for any site remediation activities which might be occasioned by the Administrative Consent Order which Exxon and the New Jersey Department of Environmental Protection and Energy ("NJDEPE") executed on November 27, 1991.

In addition, our street address has changed from "250 East 22nd Street to "1 Avenue J." It is our understanding that IMTT will be making a separate application for a new EPA ID Number under the old street address.

Please find attached our subsequent Notification of Regulated Waste Activity. Should you have any questions regarding this matter, please contact Mr. Peter DeAngelo at (201) 858-6893.

Sincerely,



PAD:dal
4-2EPA.L
Attachment

cc: T. Sherman NJDEPE - w/att
Carlos Rodriguez, Hudson Regional Health Commission - w/att
Robert Weaver, IMTT - w/o att



(4)

RCA Inspection Report

Exxon, Bayonne Plant
Foot of East 22nd Street
Bayonne, N.J. 07002
NTJ350011144

March 3, 1982

Participating Personnel: Environmental Protection Agency
J. Cosentino, Environmental Scientist

Exxon
L. Sculco

Report Prepared by: Joseph Cosentino, Environmental Scientist
Source Monitoring Section

MAR 23 1 30 PM '82
ENVIRONMENTAL
AGENCY
NEW YORK, N.Y. 10007

Purpose of Survey

This inspection was conducted to determine whether the Exxon Company, Bayonne Plant is in compliance with the requirements of RCRA. The regulatory requirements covered those contained in 40 CFR Part 262 and 40 CFR Part 265 under 265.16, Subpart C and Subpart D.

Facility Description

The Exxon Company, Bayonne Plant is a terminal for the transfer of oil and oil products. The facility is also engaged in the packaging of oil and lubricants into 1 quart, 5 quart, 5 gallon and 55 gallon containers for marketing. The facility receives via pipe line from Exxon's Bayway Plant or tank ship, stores in tanks, transfers to tank ships and trucks and packages oil and oil products. The facility occupies a 280 acre site and has been in operation for the past 104 years. Presently about 260 people are employed at the facility. Normal hours of operation are 24 hours/day, 7 days/week, 52 weeks/year.

The facility generates a sludge from an API separator which is listed as a hazardous waste from a specific source. The API separator along with a rain water retention tank and sand filters are used to treat the wastewater generated by the facility. The

wastewater consist of steam, tank draw off, non-contact cooling water and storm water run-off. The separator is cleaned annually and yields about 120 cubic yards of sludge. The sludge is collected in a plastic lined tank for dewatering, which is accomplished in 2 to 4 days. The facility maintains a contractual arrangement with BFI for the transfer, transport and disposal of the sludge. Disposal is at a BFI owned secure landfill in Maryland.

Sludges from the oil packaging operations that are leakers or contain off spec oil are drained and crushed. Together with laboratory sample containers are handled as hazardous waste because they contain a residue of waste oil. Waste oil although not presently regulated as a hazardous waste by EPA is regulated by New Jersey DEP's RCRA program.

The facility had applied as a TSD facility in its Part A application believing that its wastewater treatment system would be considered a hazardous waste treatment system and therefore be regulated under RCRA. However, under Regulation No. 264.1 the requirements of Part 264 do not apply to wastewater treatment units as defined in 260.10. The facility is in the process of applying for a delisting.

Regulatory Compliance

The facility has complied with all the applicable regulations of RCRA with one exception. The facility did not maintain written documentation of the type and amount of training given to its personnel in jobs related to hazardous waste management as required by Regulation No. 265.16.

RCRA GENERATOR INSPECTION FORM

COMPANY NAME: EXXON, BAYONNE PLANT
FOOT OF E. 22nd ST.
BAYONNE, N.J.

EPA I.D. NUMBER:
NJST 350011144

COMPANY ADDRESS:

COMPANY CONTACT OR OFFICIAL:
RON SCERBO

INSPECTOR'S NAME: J. COSENTINO

TITLE:

BRANCH/ORGANIZATION:
SOURCE MONITORING

CHECK IF FACILITY IS ALSO A TSD

DATE OF INSPECTION: 3-3-82

FACILITY ☒ FACILITY IS IN THE
PROCESS OF DELISTING

YES NO

(I) Is there reason to believe that the facility has hazardous waste on site? ☒

a. If yes, what leads you to believe it is hazardous waste?
Check appropriate box:

☒ Company admits that its waste is hazardous during the inspection.

☒ Company admitted the waste is hazardous in its RCRA notification and/or Part A Permit Application.

☐ The waste material is listed in the regulations as a hazardous waste from a nonspecific source (§261.31)

☐ The waste material is listed in the regulations as a hazardous waste from a specific source (§261.32)

☐ The material or product is listed in the regulations as a discarded commercial chemical product (§261.33)

☐ EPA testing has shown characteristics of ignitability, corrosivity, reactivity or extraction procedure toxicity, or has revealed hazardous constituents (please attach analysis report)

☐ Company is unsure but there is reason to believe that waste materials are hazardous. (Explain)

FILED
MAR 7 1982
NEW YORK, N.Y. 10001

YES NO DC
KN

- b. Is there reason to believe that there are hazardous wastes on-site which the company claims are merely products or raw materials? ✓

~~Please explain:~~

- c. ~~Identify the hazardous wastes that are on-site, and estimate approximate quantities of each.~~

API SEPERATOR SLUDGE

CRUSHED CANS

NONE ON SITE AT TIME OF INSPECTION

SPILL CLEAN UP

LAB SAMPLE CONTAINERS

- d. Describe the activities that result in the generation of hazardous waste.

OIL TRANSFER & PACKAGING

- (2) Is hazardous waste stored on site? ✓

- a. What is the longest period that it has been accumulated?

3-4 DAYS

- b. Is the date when drums were placed in storage marked on each drum?

TANK STORAGE

- (3) Has hazardous waste been shipped from this facility since November 19, 1980? ✓

- a. If "yes," approximately how many shipments were made?

129 SHIPMENTS IN ALL

6 SHIPMENTS OF 20 CU. YDS. OF API SLUDGE

- (4) Approximately how many hazardous waste shipments off site have been made since November 19, 1980?

- a. Does it appear from the available information that there is a manifest copy available for each hazardous waste shipment that has been made? ✓

- b. If "no" or "don't know," please elaborate.

	<u>YES</u>	<u>NO</u>	<u>DK</u>
c. Does each manifest (or a representative sample) have the following information?			
- a manifest document number	<u>/</u>	—	—
- the generator's name, mailing address, telephone number, and EPA identification number	<u>/</u>	—	—
- the name, and EPA identification number of each transporter	<u>/</u>	—	—
- the name, address and EPA identification number of the designated facility and an alternate facility, if any: BFI IS ONLY FACILITY USED	—	—	—
- a description of the wastes (DOT)	<u>/</u>	—	—
- the total quantity of each hazardous waste by units of weight or volume, and the type and number of containers as loaded into or onto the transport vehicle	<u>/</u>	—	—
- a certification that the materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation under regulations of the Department of Transportation and the EPA	<u>/</u>	—	—
(5) Were there any hazardous wastes stored on site at the time of the inspection?	—	<u>/</u>	—
a. If "yes," do they appear properly packaged (if in containers) or, if in tanks, are the tanks secure?	—	—	—
b. If not properly packaged or in secure tanks, please explain.			
c. Are containers clearly marked and labelled?	—	—	—
d. Do any containers appear to be leaking?	—	—	—
e. If "yes," approximately how many?			

*(6) Has the generator submitted an annual report to EPA covering the previous calendar year? _ / _

a. How do you know?

(7) Has the generator received signed copies (from the TSD facility) of all manifests for wastes shipped off site more than 35 days ago? _ / _

a. If "no," have Exception Reports been submitted to EPA covering these shipments? _ _

(8) General comments. FOR QUESTION APPLICABLE UNDER REGULATION No. 262.34 SEE PAGES 2, 3 AND 5 OF TSD CHECKLIST.

— THE CRUSHED CANS AND LABORATORY SAMPLE CONTAINERS HAVE A RESIDUE OF OIL LEFT IN THEM AFTER DRAINING. THE FACILITY HANDLES THESE AS A HAZARDOUS WASTE IN ACCORDANCE WITH N.J. REGULATIONS.

— THE API SEPERATOR SLUDGE IS GENERATED ONLY ONCE OR TWICE A YEAR WHEN THE UNIT IS CLEANED. THE SLUDGE IS HELD IN A DEWATERING TANK FOR A FEW DAYS. BFI THEN TRANSFERS THE WASTE INTO A CONTAINER AND TRANSPORTS AND DISPOSES OF IT UNDER CONTRACT.

— THE FACILITY APPLIED AND IS LISTED AS A TSD. HOWEVER, THEY ARE IN THE PROCESS OF DELISTING AS UNDER REGULATION No. 265.1 THERE WASTEWATER TREATMENT UNITS WOULD NOT BE REGULATED UNDER RCRA.

The effective date for this requirement is March 1, 1982.

RCRA TREATMENT, STORAGE AND DISPOSAL FACILITY INSPECTION FORM
FOR TSD FACILITIES ONLY

COMPANY NAME: EXXON, BAYONNE

EPA I.D. Number: N3T350011144

COMPANY ADDRESS:

COMPANY CONTACT OR OFFICIAL:

OTHER ENVIRONMENTAL PERMITS HELD

BY FACILITY: ☒ NPDES

TITLE:

☐ AIR

☐ OTHER

INSPECTOR'S NAME: J. COSENTINO DATE OF INSPECTION: 3-3-82

BRANCH/ORGANIZATION:

TIME OF DAY INSPECTION TOOK PLACE:

(1) Is there reason to believe that the facility has hazardous waste on site?

a. If yes, what leads you to believe it is hazardous waste?
Check appropriate box:

☐ Company admits that its waste is hazardous during the inspection.

☐ Company admitted the waste is hazardous in its RCRA notification and/or Part A Permit Application.

☐ The waste material is listed in the regulations as a hazardous waste from a nonspecific source (§261.31)

☐ The waste material is listed in the regulations as a hazardous waste from a specific source (§261.32)

☐ The material or product is listed in the regulations as a discarded commercial chemical product (§261.33)

☐ EPA testing has shown characteristics of ignitability, corrosivity, reactivity or extraction procedure toxicity, or has revealed hazardous constituents (please attach analysis report)

☐ Company is unsure but there is reason to believe that waste materials are hazardous. (Explain)

b. Is there reason to believe that there are hazardous wastes on-site which the company claims are merely products or raw materials?

YES NO DON'T

KNOW

Please explain:

c. Identify the hazardous wastes that are on-site, and estimate approximate quantities of each.

(2) Does the facility generate hazardous waste?

(3) Does the facility transport hazardous waste?

(4) Does the facility treat, store or dispose of hazardous waste?

VISUAL OBSERVATIONS

	<u>YES</u>	<u>NO</u>	<u>DON'T KNOW</u>
(5) <u>SITE SECURITY</u> (§265.14)			
a. Is there a 24-hour surveillance system?	—	—	—
b. Is there a suitable barrier which completely surrounds the active portion of the facility?			
c. Are there "Danger—Unauthorized Personnel Keep Out" signs posted at each entrance to the facility?	—	—	—
 (6) Are there ignitable, reactive or incompatible wastes on site? (§265.27)	—	—	—
a. If "YES", what are the approximate quantities?			
b. If "YES", have precautions been taken to prevent accidental ignition or reaction of ignitable or reactive waste?	—	—	—
c. If "YES", explain			
d. In your opinion, are proper precautions taken so that these wastes do not:			
- generate extreme heat or pressure, fire or explosion, or violent reaction?	—	—	—
- produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health?	—	—	—
- produce uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions?	—	—	—
- damage the structural integrity of the device or facility containing the waste?	—	—	—
- threaten human health or the environment?	—	—	—

Please explain your answers, and comment if necessary.

e. Are there any additional precautions which you would recommend to improve hazardous waste handling procedures at the facility?

(7) Does the facility comply with preparedness and prevention requirements including maintaining:
 (§265.32) YES

	YES	NO	DON'T KNOW
- an internal communications or alarm system?	/	—	—
- a telephone or other device to summon emergency assistance from local authorities?	/	—	—
- portable fire equipment?	/	—	—
- adequate aisle space?	/	—	—
- in your opinion, do the types of wastes on site require all of the above procedures, or are some not needed? Explain.	—	—	—

In your opinion, do the types of wastes on site require all of the above procedures, or are some not needed? Explain.

- *(8) Have you inspected to verify that the groundwater monitoring wells (if any) mentioned in the facility's groundwater monitoring plan (see no. 19 below) are properly installed? — — —

If you have, please comment, as appropriate.

- (9) a. Is there any reason to believe that groundwater contamination already exists from this facility? If "YES", explain. — — —
- b. Do you believe that operation of this facility may affect groundwater quality? — — —
- c. If "YES", explain. — — —

RECORDS INSPECTION:

- (10) Has the facility received hazardous waste from an off-site source since Nov. 19, 1980 (effective date of the regulations)? — — —
- a. If "YES", does it appear that the facility has a copy of a manifest for each hazardous waste load received? — — —
- b. How many post-November 19 manifests does it have? (If the number is large, you may estimate) — — —
- c. Does each manifest (or a representative sample) have the following information?
- a manifest document number — — —

	YES	NO	DON'T KNOW
- the generator's name, mailing address, telephone number, and EPA identification number	—	—	—
- the name, and EPA identification number of each transporter	—	—	—
- the name, address and EPA identification number of the designated facility and an alternate facility, if any;	—	—	—
- a DOT description of the wastes	—	—	—
- the total quantity of each hazardous waste by units of weight or volume, and the type and number of containers as loaded into or onto the transport vehicle	—	—	—
- a certification that the materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation under regulations of the Department of Transportation and the EPA	—	—	—
d. Are there any indications that unmanifested hazardous wastes have been received since November 19, 1980? If YES, explain.	—	—	—
(11) Does the facility have a written waste analysis plan specifying test methods, sampling methods and sampling frequency? (§265.13)	—	—	—
a. Does the character of wastes handled at the facility change from day to day, week to week, etc., thus requiring frequent testing? (You may check more than one) Waste characteristics vary _____ All wastes are basically the same _____ Company treats all waste as hazardous _____ Don't know _____	—	—	—
b. Does hazardous waste come to this facility from off-site sources?	—	—	—
c. If waste comes from an off-site source, are there procedures in the plan to insure that wastes received conform to the accompanying manifest?	—	—	—
(12) <u>INSPECTIONS</u> (§265.15)			
a. Does the facility have a written inspection schedule?	—	—	—
b. Does the schedule identify the types of problems to be looked for and the frequency for inspections?	—	—	—
c. Does the owner/operator record inspections in a log?	—	—	—
d. Is there evidence that problems reported in the inspection log have not been remedied? If "YES," please explain.	—	—	—

(13) PERSONNEL TRAINING (§265.16)

a. Is there written documentation of the following:

- job title for each position at the facility related to hazardous waste management and the name of the employee filling each job? ☒ ☐ ☐
- type and amount of training to be given to personnel in jobs related to hazardous waste management? ☐ ☒ ☐
- actual training or experience received by personnel? ☐ ☒ ☐

(14) Does the facility have a written contingency plan for emergency procedures designed to deal with fires, explosion or any unplanned release of hazardous waste? ☒ ☐ ☐
(§265.51)a. Does the plan describe arrangements made with local authorities? ☒ ☐ ☐b. Has the contingency plan been submitted to local authorities? ☒ ☐ ☐

How do you know?

COMPANY SAID SO

c. Does the plan list names, addresses, and phone numbers of Emergency Coordinators? ☒ ☐ ☐d. Does the plan have a list of what emergency equipment is available? ☒ ☐ ☐e. Is there a provision for evacuating facility personnel? ☒ ☐ ☐f. Was an Emergency Coordinator present or on call at the time of the inspection? ☒ ☐ ☐

(15) Does the owner/operator keep a written operating record with: (§265.73)

- a description of wastes received with methods and dates of treatment, storage or disposal? ☐ ☐ ☐
- location and quantity of each waste? ☐ ☐ ☐
- detailed records and results of waste analysis and treatability tests performed on wastes coming into the facility? ☐ ☐ ☐
- detailed operating summary reports and description of all emergency incidents that required the implementation of the facility contingency plan? ☐ ☐ ☐

(16) Does the facility have written closure and post-closure plans? (§265.110) ☐ ☐ ☐

a. Does the written closure plan include:

- a description of how and when the facility will be partially (if applicable) and ultimately closed? ☐ ☐ ☐

* Effective date for this requirement is May 19, 1981.

- | | | | |
|---|---|---|---|
| - an estimate of the maximum inventory of wastes in storage or treatment at any time during the life of the facility? | — | — | — |
| - a description of the steps necessary to decontaminate facility equipment during closure? | — | — | — |
| - a schedule for final closure including the anticipated date when wastes will no longer be received and when final closure will be completed? | — | — | — |
| b. What is the anticipated date for final closure? | — | — | — |
| 7c. Does the owner/operator have a written post-closure plan identifying the activities which will be carried on after closure and the frequency of these activities? | — | — | — |
| d. Does the written post-closure plan include: | | | |
| - a description of planned groundwater monitoring activities and their frequencies during post-closure? | — | — | — |
| - a description of planned maintenance activities and frequencies to ensure integrity of final cover during post-closure? | — | — | — |
| - the name, address and phone number of a person or office to contact during post-closure? | — | — | — |
| *(17) Does the owner/operator have a written estimate of the cost of closing the facility? (\$265.142) What is it? | — | — | — |
| *(18) Does the owner/operator have a written estimate of the cost for post-closure monitoring and maintenance? What is it? (\$265.144) | — | — | — |
| *(19) Has a groundwater monitoring plan been submitted to the Regional Administrator for facilities containing a surface impoundment, landfill or land treatment process? (This requirement does not apply to recycling facilities.) (\$265.90) | — | — | — |
| a. Does the plan indicate that at least one monitoring well has been installed hydraulically upgradient from the limit of the waste management area? | — | — | — |
| b. Does the plan indicate that there are at least three monitoring wells installed hydraulically downgradient at the limit of the waste management area? | — | — | — |

* This section applies only to disposal facilities.

* Effective date for this requirement is May 19, 1981.

SITE-SPECIFIC

Please circle all appropriate activities and answer questions on indicated pages for all activities circled. When you submit your report, include only those site-specific pages that you have used.

<u>STORAGE</u>	<u>TREATMENT</u>	<u>DISPOSAL</u>
Waste Pile p. 9	Tank p. 8	Landfill pp. 10-11
Surface Impoundment p. 8	Surface Impoundment pp. 8-9	Land Treatment pp. 9, 10
Container p. 7	Incineration pp. 12-13	Surface Impoundment p. 8
Tank, above ground p. 8	Thermal Treatment pp. 12-13	Other _____
Tank, below ground p. 8	Land Treatment pp. 9-10	
Other _____	Chemical, Physical p. 13 and Biological Treatment (other than in tanks, surface impoundment or land treatment facilities)	YES NO DON'T KNOW
	Other _____	

CONTAINERS (\$265.170)

1. Are there any leaking containers?
If "YES", explain. _____
2. Are there any containers which appear in danger of leaking?
If "YES", explain. _____
3. Do wastes appear compatible with container materials? _____
4. Are all containers closed except those in use? _____
5. Do containers appear to be opened, handled or stored in a manner which may rupture the containers or cause them to leak? _____
6. How often does the plant manager claim to inspect container storage areas? _____
7. Does it appear that incompatible wastes are being stored in close proximity to one another?
If "YES", explain. _____
8. Are containers holding ignitable or reactive wastes located at least 15 meters (50 feet) from the facility's property line? _____
9. What is the approximate number and size of containers with hazardous wastes? _____

TANKS (\$265.190)

YES	NO	DON'T KNOW
-----	----	---------------

- | | | | |
|---|---|---|---|
| 1. Are there any leaking tanks?
If "YES", explain. | — | — | — |
| 2. Are there any tanks which appear in danger of
leaking.
If "YES", explain. | — | — | — |
| 3. Are wastes or treatment reagents being
placed in tanks which could cause them to
rupture, leak, corrode or otherwise fail?
If "YES", explain. | — | — | — |
| 4. Do uncovered tanks have at least 2 feet
of freeboard or an adequate containment
structure? | — | — | — |
| 5. Where hazardous waste is continuously
fed into a tank, is the tank equipped with
a means to stop this inflow? | — | — | — |
| 6. Does it appear that incompatible wastes
are being stored in close proximity to one
another, or in the same tank?
If "YES", explain. | — | — | — |
| 7. How often does the plant manager claim to
inspect container storage areas? | — | — | — |
| 8. Are ignitable or reactive wastes stored in
a manner which protects them from a source
of ignition or reaction?
If "YES", explain. | — | — | — |
| 9. What is the approximate number and size of
tanks containing hazardous wastes? | — | — | — |

SURFACE IMPOUNDMENTS (\$265.220)

- | | | | |
|--|---|---|---|
| 1. Is there at least 2 feet of freeboard
in the impoundment? | — | — | — |
| 2. Do all earthen dikes have a protective
cover to preserve their structural integrity?
If "YES", specify type of covering. | — | — | — |
| 3. Is there reason to believe that incompatible
wastes are being placed in the same surface
impoundment?
If "YES", explain. | — | — | — |

4. Are ignitable or reactive wastes being placed in surface impoundments without being treated to remove these characteristics?
If "YES", explain.

— — —

5. Are there any leaks, failures or is there any deterioration in the impoundments?
If "YES", explain.

— — —

6. Give the approximate size of surface impoundments (gallons or cubic feet).

WASTE PILES (\$265.250)

1. Is the waste pile protected from wind erosion?

— — —

a. Does it appear to need such protection?

— — —

b. Explain what type of protection exists.

2. Does it appear that incompatible wastes are being stored in the same waste pile?
If "YES", explain.

— — —

3. Is leachate run-off from a pile a hazardous waste?
If "YES", explain this determination and answer (a) and (b) below.

— — —

a. Is the pile placed on an impermeable base that is compatible with the waste?

— — —

b. Is the pile protected from precipitation and run-on?

— — —

4. In your judgment, are ignitable or reactive wastes managed in such a way that they are protected from any material or conditions which may cause them to ignite?
Please explain or indicate if no such wastes are present.

— — —

Are they placed on an existing pile so that they no longer meet the definition of ignitable or reactive waste?
Please explain.

— — —

5. How many waste piles are on site, and approximately how large are they?

LAND TREATMENT (\$265.270)

1. Can the facility operator demonstrate that the hazardous waste has been made less or non-hazardous by biological degradation or chemical reactions occurring in or on the soil?

— — —

- | | | | |
|---|---|---|---|
| *2. Is run-on diverted away from the active portions of the land treatment facility? | — | — | — |
| *3. Is run-off collected? | — | — | — |
| 4. Are food chain crops being grown on the facility property? | — | — | — |
| a. If "YES", can the facility operator document that arsenic, lead and mercury: | | | |
| - will not be transferred to the crop or ingested by food chain animals or | — | — | — |
| - will not occur in greater concentrations in the crops grown on the land treatment facility than in the same crops grown on untreated soils. | — | — | — |
| b. Has notification of the growing of the food chain crops been made to the Regional Administrator? | — | — | — |
| 5. Is there a written and implemented plan for unsaturated zone monitoring? | — | — | — |
| 6. Are there records of the application dates, application rates, quantities and location of each hazardous waste placed in the facility? | — | — | — |
| 7. Do the closure and post-closure plans address: | | | |
| a. control of migration of hazardous wastes into the groundwater? | — | — | — |
| b. control of run-off, release of airborne particulate contaminants? | — | — | — |
| c. compliance with requirements for the growth of food-chain crops (if they are present)? | — | — | — |
| 8. Is ignitable or reactive waste immediately incorporated into the soil so the resulting waste no longer meets that definition? If "YES", explain. | — | — | — |
| 9. Are incompatible wastes placed in the same land treatment area? If "YES", explain. | — | — | — |
| 10. What is the area of the land receiving hazardous waste treatment? | — | — | — |

LANDFILLS (§265.300)

- | | | | |
|---|---|---|---|
| *1. Is run-on diverted away from the active portions of the landfill? | — | — | — |
| *2. Is run-off from active portions of the landfill collected? | — | — | — |

* Effective date for these requirements is May 19, 1981.

† These requirements are effective November 19, 1981.

- | | | | |
|---|---|---|---|
| 3. Is waste which is subject to wind dispersal controlled?
Explain. | — | — | — |
| 4. Does the owner/operator maintain a map with: | | | |
| - the exact location and dimensions of each cell | — | — | — |
| - the contents of each cell and approximate location of each hazardous waste type | — | — | — |
| 5. Do the closure and post-closure plans address: | | | |
| - control of pollutant migration via ground water? | — | — | — |
| - control of surface water infiltration? | — | — | — |
| - prevention of erosion? | — | — | — |
| 6. Is ignitable or reactive waste treated before being placed in the landfill?
Explain how you know. | — | — | — |
| 7. Are precautions taken to insure that incompatible wastes are not placed in the same landfill cell?
If "NO", explain. | — | — | — |
| 8. Are bulk or non-containerized wastes containing free liquids placed in the landfill?
If "YES", | — | — | — |
| a. Does the landfill have a liner which is chemically and physically resistant to the added liquid? | — | — | — |
| b. Is the waste treated and stabilized so that free liquids are no longer present? | — | — | — |
| 9. Are containers holding liquid waste or waste containing free liquids placed in the landfill? | — | — | — |
| 10. Are empty containers (e.g. those containing less than 1/2 inch of liquid) placed in the landfills?

If so, are they crushed flat, shredded or similarly reduced in volume before they are buried? | — | — | — |
| 11. What is the approximate area of the hazardous waste landfill? | | | |

INCINERATORS AND THERMAL TREATMENT
(55265.340 and 265.379)

YES NO DON'T KNOW

1. What type of incinerator or thermal treatment is at the site (e.g. waterwall incinerator, boiler, fluidized bed, etc.)? _____
2. Was hazardous waste being incinerated or thermally treated during your inspection?
If "YES", answer all following questions. _____
If "NO", answer only questions 3 and 7. _____
3. Has waste analysis been performed (and written records kept) to include:
 - heating value of the waste _____
 - halogen content _____
 - sulfur content _____
 - concentration of lead _____
 - concentration of mercury _____

NOTE: Waste analysis need not be performed on each waste load if
if there are documented data available to show waste characteristics
that do not vary. If there are such documented data available,
check here ☐.

4. Does it appear that the owner/operator brings his thermal treatment process to steady state (normal) conditions of operation before introducing hazardous wastes? _____
5. Did it appear during your inspection that there was adequate monitoring and inspection by owner/operator every 15 minutes during hazardous waste incineration for:
- waste feed _____
 - auxiliary fuel feed _____
 - air flow _____
 - incinerator temperature _____
 - scrubber flow _____
 - scrubber pH _____
 - relevant level controls _____
- Every hour for:
- stack plume (color and opacity) _____
5. Is there open burning of hazardous waste?

- a. If "YES", what is being burned?
(only burning or detonation
of explosives is permitted)
- b. If open burning or detonation of explosives is taking
place, approximately what is the distance from the open
burning or detonation to the property of others?

YES NO DON'T
KNOW

6. Does the incinerator appear to be operating
properly? (Do emergency shutdown controls
and system alarms seem to be in good working
order?) Please explain.

— — —

- a. Is there any evidence of fugitive emissions?

— — —

7. Is the residue from the incinerator treated
by the owner as a hazardous waste?
Please explain.

— — —

8. What types of air pollution control devices (if any)
are installed on the incinerator?

CHEMICAL, PHYSICAL AND BIOLOGICAL TREATMENT (\$265.400)

1. Does the treatment process system show any
signs of ruptures, leaks, or corrosion?
Please explain.

— — —

2. Is there a means to stop the inflow of
continuously-fed hazardous wastes?

— — —

3. Is there ignitable or reactive waste fed
into the treatment system?

— — —

If "YES", has it been treated or protected
from any material or conditions which may
cause it to ignite or react? If so,
explain how.

— — —

Are the incompatible wastes placed in
the same treatment process?
If "YES", explain.

— — —

5. Describe the treatment system at this facility.

EXXON COMPANY, U.S.A.

POST OFFICE BOX 9000 • BAYONNE, NEW JERSEY 07002-9000

REFINING DEPARTMENT
BAYONNE PLANT

December 7, 1984

Exxon Bayonne Plant
Foot of East 22 Street
Bayonne, New Jersey
NJT350011144

Mr. Frank Coolick, Chief
Bureau of Hazardous Waste Engineering
32 East Hanover Street
Trenton, New Jersey 08625

Dear Mr. Coolick:

This letter is in response to your request for additional information required by the Bureau to complete a review of the Exxon Bayonne TSD Status Delisting Request. The following information is submitted in response to your specific questions in your letter of November 20, 1984. The information is numbered to correspond to your letter.

- (1) Tank Storage (S02) and Treatment (T01) are concrete separators, five steel storm water retention tanks, and one steel oil recovery tank associated with our NJPDES facilities (NJ0002089). Attached is a schematic of plant water flow which was submitted with our most recent NJPDES renewal application. This schematic shows all sources of waste generation on-site which subsequently use the aforementioned S02 and T01 facilities.
- (2) - Effluent is discharged from these facilities through two permitted discharge points to Upper New York Bay and the Kill Van Kull.
 - Oil skimmed from the facilities is recycled and blended with #6 Fuel Oil for sale.
 - Sludge removed from the facilities is disposed of at CECOS International, Niagara Falls, New York, a licensed TSD facility (NYD080336241). Recent sampling of this material shows it to be non-hazardous under RCRA. A copy of the Lab Analysis was attached to our letter of June 25, 1984,

Hopefully, this information clarifies any questions concerning our delisting request. If any additional information is needed, please contact Mr. R. E. Scerbo at 201-858-5544.

Very truly yours,

W. L. Taetzsch
W. L. Taetzsch
Environmental Coordinator

REScerbo:vh
Attachment

20621
EXXON COMPANY, U.S.A.

POST OFFICE BOX 222 • LINDEN, NEW JERSEY 07036

REFINING DEPARTMENT
BAYWAY REFINERY

March 29, 1983

TSD Interim Status
Exxon Bayonne Plant
I. D. No. NJT 350011144
File No.: 10-6-4b-3

Frank Coolick, Chief
Bureau of Hazardous Waste Engineering
Department of Environmental Protection
32 East Hanover Street
Trenton, New Jersey 08625

Dear Mr. Coolick:

In response to your letter of February 16, 1983, regarding the submission of a 1982 TSD Annual Report for our Bayonne Plant, we request that the Plant be removed from the TSD interim status facility list.

Our letter of November 15, 1982 to David Shotwell, which was subsequently forwarded to your office, stated the reasons why the Plant is not a TSD facility. A copy of the letter is attached.

Since New Jersey has now received authorization from the EPA for the RCRA Phase I program and since your letter instructions note that no contact with the EPA is required, we do not plan to submit a revised Part A application to the EPA.

Should you require any additional information about the Bayonne Plant operations or its classification, please call me on (201) 474-7585.

Very truly yours,



W. L. Taetzsch
Environmental Coordinator

WLT/lk
Attachment

MEMONEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTECTIONTO Shirlee Schiffman, Acting Chief, BHWCMFROM Frank Coolick, Chief, BHWE *FC*DATE 21 FEB 1985SUBJECT Exxon Bayonne Plant
Foot of East 22nd Street
Bayonne, NJ
NJT 350 011 144

VC
C1105=4
3/15
CO

Attached, please find copies of the March 29, 1983, June 25, 1984, and December 7, 1984 correspondence from the above subject facility for your review.

Exxon contends that the DAF float, heat exchanger bundle cleaning sludge, and API separator sludge are not listed hazardous wastes. Exxon considers K048, K050, and K051 waste codes not to correctly identify the aforementioned waste streams because their waste is not generated from the petroleum refining industry, but rather from petroleum terminaling. Is petroleum terminaling a part of the petroleum refining industry?

The waste water generated on-site as depicted in the December 7, 1984 letter is considered by Exxon to be a non-hazardous waste. Is the waste water a hazardous waste?

The two oil/water concrete separators produce a skimmed oil. This oil is stored in a tank then blended with #6 fuel oil and sold as barge fuel. Is this skimmed oil a hazardous waste?

Before the BHWE can consider this facility for delisting the aforementioned classifications must be made. Any information you require for these classifications should be formally forwarded to the BHWE (in a memo). The BHWE will contact the facility directly for this information.

Please respond to this memo within thirty days from the date of this memo.

EP6/slw
Att.

c: ☒ A. Chang, USEPA

3

EPA I.D. No.

Name

City

NJD930525693

IT Corporation

Edison

NJD980526867

Shielding Technology

Piscataway

NJD980535959

Marko Engraving & Art Corp.

Fairview

NJD980594022

E.L. Beth Ltd.

Edison

NJD980642888

Kelbro, Inc.

Camden

NJD991304148

Viking Terminal Company

Sayreville

NJT000028134

Barone Barrel & Drum Company

Paterson

NJT350011144

Exxon Bayonne Plant

Bayonne

NJT350014585

Campbell Foundry Company

Kearny



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

MAY 26 1983

REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10278

MAY 26 1983

Mr. George Tyler
Assistant Commissioner for
Environmental Management and Control
New Jersey Department of
Environmental Protection
Labor and Industry Building, Room 805
P.O. Box CN 402
Trenton, New Jersey 08625

Dear Mr. Tyler:

On January 31, 1983, the Environmental Protection Agency (EPA) Region II sent 302 warning letters (sample copies enclosed) to owners and operators of hazardous waste facilities which were not in compliance with EPA's financial responsibility regulations. These regulations became effective in July 1982 and required facilities to demonstrate that funds are available for:

- ° meeting their obligations under the Resource Conservation and Recovery Act (RCRA) for proper closure and post-closure care of their facilities (i.e., "financial assurance"); and
- ° compensating others for bodily injury or property damage caused by accidents arising from operations of the facilities (i.e., "liability insurance").

The following is to summarize industry's compliance to date (or lack thereof) with the Federal financial responsibility regulations. See the enclosed computer printout for a listing of the facilities in compliance with the Federal regulations. Also enclosed is a listing of the facilities within each non-compliance category.

- ° Number of facilities which have submitted all required documents (including those facilities that have utilized the financial test and corporate guarantee methods of compliance) - 279
- ° Number of facilities which demonstrated financial assurance only - 10

- ° Number of facilities which demonstrated liability insurance only - 28
- ° Number of "non-submitters" (excluding facilities which either closed or requested to be declassified as hazardous waste facilities) - 56

The above numbers indicate that 94 facilities are in violation of the Federal and State financial responsibility requirements. Our concern is whether the State or EPA should proceed with enforcement follow-up activities for these 94 facilities. The State's financial regulations, which have been in effect since October 1981, are even more stringent than the Federal regulations in that they do not provide facilities with the option of using the corporate guarantee or the financial test for demonstrating proof of financial assurance and liability insurance. Two hundred and thirty facilities have utilized these alternative methods (see the enclosed computer printout for a listing of facilities which employed these methods). Now that New Jersey has received Phase I interim authorization, the State is responsible for enforcing financial regulations in lieu of EPA. However, the Phase I Memorandum of Agreement (MOA) does provide that EPA can initiate enforcement actions in cases where the State does not initiate timely and appropriate enforcement actions against violators. Regardless of which Agency takes the lead, enforcement actions must be based on the State's financial regulations (see enclosed EPA guidance on enforcement actions in authorized States).

Please notify me within the next two weeks as to the State's plan of action (including time frames) for conducting follow-up enforcement activities for the 94 facilities identified in the enclosure. (Of course, some of these facilities may have already provided the State with financial documentation pursuant to State regulations and would therefore not be considered enforcement candidates by New Jersey.) My staff and I are ready to provide assistance to New Jersey in implementing this high priority portion of the State's Phase I hazardous waste program. Alternatively, if the State chooses not to take the enforcement lead at this time, EPA is ready to proceed with initiating said enforcement actions and will keep New Jersey informed of its activities.

Exxon Bayonne Plant, New Jersey

**Results of Field Investigation for Free Oil Recovery
Delineation
and Basic Design
Free Oil Recovery Project (FORP)**

March 1998 (revised March 1999)

Volume I - Text

Volume II - Appendices

Volume III - Appendices

Submitted to:

Exxon Company, USA
Corner of Park and Brunswick Avenue
Linden, New Jersey 07036

and

State of New Jersey Department of Environmental Protection
401 E. State Street
Trenton, New Jersey 08625 (March 1999 revisions not submitted)

Prepared by:

Parsons Engineering Science, Inc.
30 Dan Road
Canton, Massachusetts 02021-2809

BBG0000001

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A	NJDEP Correspondence <ul style="list-style-type: none">• NJDEP March 29, 1996 letter• NJDEP April 9, 1996 letter
B	Groundwater Contour Map Reporting Forms <ul style="list-style-type: none">• Figure 3-1 (unconfined groundwater zone)• Figure 3-1 (confined groundwater zone)
C	Plume 1 <ul style="list-style-type: none">• NJDEP Well Installation Permits• Free Oil/Water Level Measurements• Soil Boring Logs• Tidal Influence on Free Oil Thickness - Data and Graphs• Free Oil Baildown Test Data and Graphs• Free Oil Skimming and Pumping Test Data• Physical Testing Results• Chemical Testing Results
D	Plume 2 <ul style="list-style-type: none">• NJDEP Well Installation Permits• Free Oil/Water Level Measurements• Soil Boring Logs• Tidal Influence on Free Oil Thickness - Data and Graphs• Free Oil Baildown Test Data and Graphs• Free Oil Skimming and Pumping Test Data• Physical Testing Results• Chemical Testing Results

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- Well Construction Diagrams
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- Free Oil Skimming and Pumping Test Data and Graphs
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 - Free Oil/Water Level Measurements
 - Soil Boring Logs
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- Soil Boring Logs
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- Well Construction Diagrams
- Free Oil Baildown Test Data and Graphs
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- Physical Testing Results
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Plume 13-AH and 13-IC1

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- Free Oil/Water Level Measurements
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- Physical Testing Results
- Chemical Testing Results

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Plume 17 and Outlier Plume

- NJDEP Well Installation Permits
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Q

Preliminary Survey of Free Phase Hydrocarbons - Exxon Bayonne Free Oil Recovery Project, January 8, 1998, Battelle.

October 1998 Survey of Free Phase Hydrocarbons - Exxon Bayonne Free Oil Recovery Project, November 18, 1998, Battelle.

Appendices - Volume III

<u>Letter</u>	<u>Title</u>
M (supplement)	Plume 13-ICI A, B, and C
	<ul style="list-style-type: none">• NJDEP Well Installation Permits• Free Oil/Water Level Measurements• Soil Boring Logs• Well Construction Diagrams• Free Oil Baildown Test Data and Graphs• Free Oil Skimming and Pumping Test Data and Graphs• Physical Testing Results• Chemical Testing Results

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1.2 Summary and Results

As part of the FORP investigation work, the following tasks were performed (site-wide):

- Installed 224 new temporary wells to supplement data from 105 previously installed temporary wells.
- Installed 26 permanent wells to supplement 157 existing permanent wells.
- Delineated the site-wide free oil plumes using multiple free oil thickness measurements from a total of 518 wells,
- Collected and analyzed 53 free oil samples using GC fingerprinting methods to support plume characterization,
- Collected and analyzed 62 vadose zone soil samples for % oil, % water, bulk density, porosity, and grain size analyses to define potential on-going sources, and to provide design data,
- Conducted 67 bail down tests in wells to support defining true free oil thicknesses in the formation.
- Conducted two rounds of site-wide water levels in 190 monitoring wells to define site-wide groundwater contours,
- At the ICI site, conducted an additional round of water levels in 72 wells on the ICI and Exxon site.
- Conducted 16 free oil skimming tests, 22 total dual fluids recovery tests, and 20 vacuum enhanced total dual fluids recovery tests to define the feasibility of free oil recovery at specific plumes, and to support the design of future free oil recovery systems.

By completing the FORP field investigation program Exxon has completed the delineation of seventeen plumes (1 through 3, and 5 through 17) in the unconfined groundwater zone and one plume (16a) in a confined groundwater zone, and the delineation will meet the goals of the FORP IRM.

The existing Plume 4 (at Tank 1066) was not made part of the FORP project, because it was previously fully delineated and is being remediated under a comprehensive free oil recovery system.

The horizontal extents of the apparent free oil thickness plumes and the true free oil thickness plumes, are shown on **Figure 1-3** and **Figure 1-4**, respectively:

- Plume 1 (Pier 7)
- Plume 2 (Pier 6)
- Plume 3 (Pier 6)
- Plume 5 (General Tank Field)
- Plume 6 (General Tank Field)
- Plume 7-AV and 7-DT (AV Gas and Domestic Trade Areas)
- Plume 8/9 (Exxon Chemicals and Asphalt Plant Areas)
- Plume 10 (No. 3 Tank Field)
- Plume 11 (Main Building Area)
- Plume 12 (No. 2 Tank Field and Main Building Area)
- Plume 13-AH and 13-ICI A, B, and C (A Hill Tank Field and ICI off-site Property)
- Plume 14 (Lube Oil Area)
- Plume 15 (Platty Kill Canal Area)
- Plume 16 (Platty Kill Canal Area)
- Plume 16a (Platty Kill Canal Area)
- Plume 17 (Helipad Area) and Outlier Plume

In this report, each of the plumes identified above are described in terms of its apparent oil thickness (as measured in wells), which is an exaggerated thickness, as well as its true oil thickness (what exists in the formation materials). This oil exaggeration in the wells is governed primarily by the grain size of the formation materials, such that the finer grained materials tend to produce a greater exaggeration in the

wells. Grain size analysis results for subsurface soils within the plumes indicate that they have a relatively high percentages of combined fine sand and silt/clay fractions (Table 1-2). Thus, the exaggeration ratios in the monitoring wells at the Bayonne facility would be expected to be relatively high.

Given that the apparent thicknesses measured in the wells are not representative of the thickness of oil in the formation materials, the conceptual free oil recovery design options evaluated at each plume will be based on a conservative estimate of the true thicknesses for each plume.

Based on criteria described in the FORP Workplan, and the results of the field investigation, three plumes (1, 7-AV, 10, and 13-ICI A) were identified where sustained free oil recovery equal to or greater than the 0.1 gpm cut-off criteria was achieved; at Plumes 1 and 7-AV extension of an existing trench system is also a conceptual remedial alternative. At eight of the plumes (2, 3, 6, 7-DT, 8/9, 13-AH, 14, and 17) active "sustained" free oil recovery in vertical wells would not be practicable using the 0.1 gpm cut-off criteria but, conceptually, free oil recovery could be recovered at lower rates, either through individual well systems or interceptor/recovery trench systems. At 2 plumes (11 and 12) continued recovery via the Interceptor Trench is practicable. Because of limited free oil thickness, and extreme low recovery rates encountered, only intermittent free oil recovery from well(s) would be feasible at three plumes (16, 16A, and 13-ICI B). Finally, natural or *in-situ* bioremediation and monitoring, possibly supplemented with intermittent free oil skimming from the existing wells, are practicable conceptual methods at three plumes (5, 15, and Outlier). Due to the extremely low recovery rate at Plume 13-ICI C, containment is a practicable option at this plume. Table 1-1 presents further details and supporting data relative to the above conceptual recommendations.

The following sections presents summary data on delineation and recovery tests at individual plumes.

1.2.1 Plume 1

Free Oil Delineation

- Plume 1 exists along the access road to Pier 7, parallel to the east-west trending gantry walls. The Upper New York Bay is the only off-site downgradient property. The apparent oil thickness plume is elongate and the maximum free oil thickness measured was 4.31 feet.
- A true oil thickness exaggeration ratio of 4 was used as a conservative value. Based on this ratio, the true oil thickness plume in the formation is limited to four individual globular areas, with a maximum true free oil thickness of 1.08 feet. The true thickness plume will be used to develop oil recovery options at Plume 1.
- The oil within Plume 1 is dominated by variously weathered diesel range product(s) (e.g., diesel fuel or fuel oil #2). The viscosity of the oil ranges between low and relatively high.

Free Oil Recovery Design Data

- Currently, Exxon recovers free oil from 12 on site wells twice a week via vacuum truck. In addition, there is a "multi-level perforated French drain system" at the western portion of the plume that collects free oil and conveys it to Sheri 3 well sump. Also, at well EBR11 free oil is recovered through a single total fluid pump system (about 5 gpm), operated manually for about 4 hours a day, 5 days a week.

- The free oil recovery options based on the true oil thickness at Plume 1 include two conceptual methods, 1) extension of the existing horizontal drain recovery systems at recovery well Sheri 3, and 2) active skimming or vacuum enhanced pumping from vertical recovery wells. These methods would address the four globular areas of Plume 1 where the true oil thickness is greater than 0.1 feet.
- In the two westernmost globular areas of Plume 1, free oil can be recovered most effectively by upgrading and extending the existing horizontal drain recovery system associated with Sheri 3. Because of the tidal fluctuations in the area, multi-level collection drains should be used.
- In the two easternmost globular areas of Plume 1, the most practical method for free oil recovery is via installation of individual skimming recovery wells.
- Oil recovery using either of these methods would need to account for tidal fluctuations, bulkhead construction materials, and the heterogeneous nature of the fill.

1.2.2 Plumes 2 and 3

Free Oil Delineation

- Plume 2 is located approximately 100 feet north of Pier 6. The Upper New York Bay is the only potential off-site downgradient property. The apparent oil thickness plume is elongated in an east-west direction and the maximum apparent free oil thickness was 0.49 feet.
- At Plume 2, an exaggeration ratio of 3.5 was used to depict the true oil thickness plume. Based on this ratio, the true thickness plume is circular in shape and the maximum true free oil thickness was 0.14 feet.
- Plume 3 is an irregularly shaped plume that exists immediately south of Pier 6. The Upper New York Bay is the only potential off-site downgradient property. The maximum free oil thickness was 2.11 feet.
- An exaggeration ratio of 3.5 was used for Plume 3. Based on this ratio, the true oil thickness plume is an irregularly shaped plume, but covers less area than the apparent oil thickness plume. The maximum true free oil thickness in Plume 3 was 0.60 feet.
- The oil within Plumes 2 and 3 is characterized as a severely weathered automotive gasoline or moderately weathered kerosene, Jet A, JP-1 or JP-5. The exception is of one area in the southern portion of Plume 3; it contained a middle to heavy distillate fuel (fuel oil #6) and/or crude oil.

Free Oil Recovery Design Data

- At Plume 2, free oil recovery is not practicable at this time, because recovery rates were less than 0.1 gpm cut-off criteria. However, conceptual remedial methods for free oil recovery will be evaluated even through yields less than the 0.1 gpm rate for free oil skimming are anticipated. Specifically, a skimming program would be best implemented at existing well EBR12 for two reasons. First, because the maximum true oil thickness was found at this well, and second, because this well is located in a downgradient position within the plume.
- At Plume 3, free oil recovery is not practicable at this time, because recovery rates were less than 0.1 gpm cut-off criteria. However, other conceptual recovery methods that would yield rates less than

this cut-off criteria include sustained free oil pumping using total dual fluids pumping or vacuum enhanced dual fluids pumping from vertical recovery wells. Multiple wells would be required which would utilize the two existing recovery wells (EBR18 and EBR21), and new wells installed at the central portions of the plume (because the two existing recovery wells occur at the extreme eastern and western ends of the plume).

1.2.3 Plumes 5 and 6

Free Oil Delineation

- Plume 5 is located within the General Tank Field and the Upper New York Bay is the only potential off-site downgradient property. The apparent oil thickness plume is comprised of two small areas which have a maximum apparent free oil thickness of 0.2 feet.
- At Plume 5 an exaggeration ratio of 6 was used to depict the true oil thickness plume. At all locations the true free oil thickness was less than 0.1 feet.
- Plume 6 is located at the southern end of the General Tank Field. The Upper New York Bay is the only potential off-site downgradient property. The apparent oil thickness plume is oval-shaped, and a small, separate area of oil occurs to the west of this plume. The maximum apparent free oil thickness was 7.67 feet.
- At Plume 6, an exaggeration ratio of 6 was used. Based on this ratio, the true oil thickness plume is an irregularly shaped oval with a maximum true free oil thickness of 1.28 feet.
- The oil in Plume 6 is predominantly comprised of a moderately degraded diesel fuel or fuel oil #2. Plume 5 oil is a mixture of moderately degraded diesel fuel/fuel oil #2 and some unique, heavier, waxy materials; it is clearly distinct from the Plume 6 oils. In addition, Plume 4 contained oil that was completely unrelated to those observed at Plume 6. The viscosity of the oil in Plume 6 ranged from low to moderate.

Free Oil Recovery Design Data

- At Plume 5, recovery of oil is not practicable because there is no discernible/recoverable free oil present (i.e., the true thickness of oil is less than 0.1 feet). Conceptually, natural or *in-situ* biodegradation and monitoring should be considered as a long term remedial method.
- At Plume 6, the conceptual free oil recovery options include: 1) extension of the existing horizontal drain recovery systems at recovery well Sheri 3; the existing perforated drain system would have to be extended approximately 500 feet to the west, and 2) active total dual fluids or vacuum enhanced pumping from vertical recovery wells, both of which are not practicable because they would result in a recovery rate less than the 0.1 gpm criteria, but conceptually these methods will be evaluated. Plume 6 is outside the area of tidal influence.

1.2.4 Plumes 7-AV and 7-DT

Free Oil Delineation

- Plume 7 is present as two distinct plumes in both the AV Gas (Plume 7-AV) and Domestic Trade (Plume 7-DT) Areas, based on the apparent free oil thickness measured in wells on-site.

- In the AV Gas Area, Plume 7-AV (apparent oil thickness) has two main lobes that are joined to the north. The greatest apparent free oil thickness of 9.91 feet was measured in the northern portion of the eastern lobe. An exaggeration ratio of 6 was used to depict the true oil thickness plume. Based on this ratio, the true thickness plume is horseshoe-shaped, and the maximum true free oil thickness was 1.65 feet.
- In the Domestic Trade Area, Plume 7-DT (apparent oil thickness) is roughly circular in shape and occupies the west-central portion of this area. The greatest apparent free oil thickness here was 7.41 feet. In this plume an exaggeration ratio of 4 was used and the resulting true thickness plume has a maximum thickness of 1.85 feet.
- The oil in the eastern lobe of Plume 7-AV is characterized as a mixture of moderately weathered diesel #1 and a gasoline range products; the viscosity of the oil ranged from low to relatively high. In the western lobe of Plume 7-AV, the oil was moderately to severely degraded heavy fuel oil, and mixture of aromatic solvent, diesel range products, and lube or asphalt type products. The oil in Plume 7-DT is characterized as moderately weathered diesel fuel or fuel oil #2 mixed with gasoline range products; the viscosity of the oil is relatively low.

Free Oil Recovery Design Data

Plume 7-AV

- At Plume 7-AV, Exxon currently monitors free oil thickness and recovers free oil (and water) from well ITMW1 twice a week using a vacuum truck. Approximately 6 gallons of oil is recovered from this well during each event.
- At Plume 7-AV, the free oil recovery options include two potential methods, 1) continued use of the existing interceptor trench, and, possibly, extension of this trench, and 2) active total dual fluids pumping from vertical recovery wells. Plume 7-AV is outside the area of tidal influence.
- At the western lobe of Plume 7-AV, continued use of the interceptor trench is the most appropriate remedial method, because this lobe of the plume is upgradient of the trench. A potential alternative for this method would be to extend an arm of the trench into the southern portion of this lobe of the plume to increase the effectiveness of the recovery; an additional oil collection sump would be utilized.
- At the eastern lobe of Plume 7-AV, extending the interceptor trench approximately 300 feet to the east so that it intercepts the oil in this lobe of the plume is the most appropriate remedial method; an additional oil collection sump would be utilized if the trench were extended. An alternative to this might be active total dual fluids pumping.
- Additional wells that use total dual fluids pumping would have to be used to address the free oil in the central and extreme southern portions of this lobe of Plume 7-AV, because groundwater flow directions in this area shift to the east making it unlikely that an extension of the trench would be effective for this portion of the plume.

Plume 7-DT

- At Plume 7-DT, free oil recovery is not practicable at this time, because recovery rates were less than 0.1 gpm cut-off criteria. However, conceptual recovery methods that would yield rates less than this

will be evaluated even through low recovery rates (<0.01 gpm) are expected. Methods include active vacuum enhanced total dual fluids pumping. While oil skimming and total dual fluids pumping are also conceptually feasible, they were less effective than vacuum enhanced testing.

- Extending the eastern end of the Interceptor Trench (noted above for Plume 7-AV) would not capture Plume 7-DT, because the groundwater flow direction in the Domestic Trade Area is to the north-northeast, away from the area into which the trench would potentially be extended.

1.2.5 Plume 11

Free Oil Delineation

- Plume 11 is located at the northwestern end of the Interceptor Trench, which bisects the plume. The apparent thickness plume is generally globular in shape and maximum apparent free oil thickness was 0.9 feet.
- An exaggeration ratio of 6 was used to depict the true thickness plume. When this ratio is applied, the true thickness plume is composed of only two small areas of oil, both of which have a maximum true free oil thickness of 0.15 feet.
- The oil from the northern end of the plume is a moderately to severely weathered heavy fuel oil product (#6 fuel oil) or crude oil. The viscosity of this sample and another sample from the southern end of the plume are significantly different, suggesting that Plume 11 may be composed of two different types of oil.

Free Oil Design Data

- At Plume 11, the most appropriate conceptual free oil recovery method would be continued use of the Interceptor Trench. Plume 11 is outside the area of tidal influence. The Interceptor Trench bisects Plume 11 and based on the converging groundwater flow in this area, the trench will contain the free oil in Plume 11.

1.2.6 Plume 12

Free Oil Delineation

- Plume 12 is predominantly located on the south side of the Interceptor Trench. The apparent thickness plume is generally circular in shape, however, it is elongated in a northwest-southeast direction where the plume meets the Trench. The maximum free oil thickness was 3.31 feet.
- An exaggeration ratio of 6 was used to depict the true thickness plume. Using this ratio, the plume is roughly circular in shape, and its maximum true free oil thickness is 0.55 feet.
- The GC fingerprint results indicate that the free oil sample on the south side of the Interceptor Trench within Plume 12 is different than the sample from the north side of the Trench (note that the oil was not consistently present in the wells north of the trench). The oil south of the trench is a slightly weathered diesel fuel #2 or fuel oil #2. North of the trench the oil is a mixture of moderately weathered mid-heavy fuel oil admixed with an unspecified unweathered gasoline range product (the oil was intermittently present in the well in the area north of the Trench). The viscosity of the oil was relatively low.

Free Oil Recovery Design Data

- At Plume 12, the most appropriate conceptual free oil recovery method would be continued use of the Interceptor Trench. The Interceptor Trench is located hydraulically downgradient of Plume 12. The close proximity of the plume to the Trench, and the overall configuration of the plume at its northern edge, indicates that the Trench is capturing the plume.

1.2.7 Plume 8/9

Free Oil Delineation

- Plume 8/9 is present in the former Exxon Chemical Plant Area. The apparent thickness plume is roughly circular in shape, except that it is slightly elongated to the southeast on its downgradient end. The maximum apparent free oil thickness was 4.05 feet.
- The true free oil thickness plume was depicted using an exaggeration ratio of 6. The true thickness plume is generally smaller compared to the apparent thickness plume. The maximum true free oil thickness in this plume was 0.68 feet.
- Three of the four oil samples within Plume 8/9 contained oil comprised of mixtures of different types. A xylene-dominant gasoline range product occurred in all three wells, and two other wells shared an unusual lube oil/asphalt product, thereby supporting a shared source. However, there were also numerous differences noted between the samples. These differences argue for multiple sources within the plume that have yielded a heterogeneous plume of oil in this area. A fourth sample along the southern boundary of the plume was distinct from the others; it was composed of a moderately weathered diesel fuel #2/fuel oil #2. The viscosity of the oil ranged from low to moderate.

Free Oil Recovery Design Data

- At Plume 8/9, free oil recovery is not practicable at this time, because recovery rates were less than 0.1 gpm cut-off criteria. However, conceptual recovery methods that would be evaluated, although the expected yield rates would be < 0.01 gpm, are: 1) sustained free oil recovery using total fluids or vacuum enhanced pumping from wells and 2) recovery of oil in a horizontal recovery trench system along the property boundary. Recovery using a trench system would prevent possible migration of the plume onto off-site properties. Given the low projected recovery rates, a trench system would be a better system to collect oil at this property boundary. The configuration of the trench would have to account for the presence of railroad tracks and pipelines in the southern portion of the plume.
- Plume 8/9 is outside the area of tidal influence.

1.2.8 Plume 10

Free Oil Delineation

- Plume 10 is present in the No. 3 Tank Field. The apparent thickness plume is oval-shaped and covers the southern portion of the No. 3 Tank Field and extends to off-site properties south of Lower Hook Road. The maximum free oil thickness in the No. 3 Tank Field was just over 8 feet, and off-site the maximum thickness 7.65 feet.

- An exaggeration ratio of 6 was used to depict the true free oil thickness plume. When this ratio is used, the true thickness plume is generally smaller compared to the apparent thickness plume, however, the shape is similar. The maximum true free oil thickness in this plume was 1.67 feet.
- The majority of the oil within Plume 10 contains a similar mixture of a moderately weathered diesel fuel/fuel oil #2 product, and an unweathered, unidentified gasoline range product. This indicates that the oil shares a common source. Oil from one area of the plume was chemically distinct from the other oils in Plume 10, and may have a different source. The viscosity of the oil was relatively low.

Free Oil Recovery Design Data

- At Plume 10, the conceptual free oil recovery options include: 1) active skimming, total dual fluids or vacuum enhanced pumping of free oil from vertical wells and, 2) use of an interceptor trench along the property boundary north of Lower Hook Road. Plume 10 is outside the area of tidal influence. The array of recovery wells would include the two permanent wells (GMMW7 and GMMW16) off-site in the south-central portion of the plume near Lower Hook Road, but additional recovery wells would have to be added within the plume. Additionally, a series of recovery wells could be installed along the property boundary to prevent off-site migration of plume.
- Because off-site migration of the plume is of primary concern at this area, a recovery trench installed along the northern portion of Lower Hook Road would also be effective in preventing continued off-site migration of this plume. Based on the true thickness plume, this trench would need to be at least 600 feet long. If it were installed along Lower Hook Road, the trench would be downgradient of the majority of the plume.

1.2.9 Plumes 13-AH and 13-ICI A, B, and C

Free Oil Delineation

- Plume 13 is actually comprised of four separate plumes, one that occurs in the southern portion of the A Hill Tank Field and the Main Building Area (Plume 13-AH), and three other, predominantly off-site, plumes (13-ICI, A, B, and C) that are located on the ICI property to the north; one of the plumes (13-ICI A) extends south into the A Hill Tank Field.
- Plume 13-AH (apparent free oil thickness) is elongated in an east-west direction which is consistent with the expected directions of groundwater flow, considering that a groundwater divide was defined in this area of the site. Due to this divide, the eastern portion of this plume would flow toward the Interceptor Trench, and the western portion would flow toward the Platty Kill Canal. The maximum free oil thickness was 9.55 feet.
- At Plume 13-AH, an exaggeration ratio of 5 was used to depict the true thickness plume. The extent of the true thickness plume is generally smaller compared to the apparent thickness plume, however, its shape is similar. The maximum true free oil thicknesses in this plume was 1.95 feet.
- Plume 13-ICI A (apparent free oil thickness) is irregularly-shaped and covers a relatively large area. The maximum apparent free oil thickness was 10.08 feet, which was measured on the ICI Americas site. The maximum thickness within the A Hill Tank Field was 4.91 feet.

- Plume 13-ICI B (apparent free oil thickness) is irregularly shaped and exists in the far eastern portion of the ICI site. The maximum apparent free oil thickness was 4.17 feet. This plume is suspected to be connected to the west end of Plume 11.
- Plume 13-ICI C (apparent free oil thickness) is roughly circular in shape. The maximum apparent free oil thickness was 0.97 feet. The distribution of oil within this plume is likely to be discontinuous as the oil is likely to be associated with the former, elongate and irregularly-shaped, storage lagoons in this area of the ICI site (**Figures 1-3 and 1-4**).
- At Plume 13-ICI A, B, and C, the true free oil thickness plume was depicted using an exaggeration ratios of 3, 2, and 2 (estimated), respectively. The extent of the true thickness plume is generally smaller compared to the apparent thickness plume, however, its shape is similar. The maximum true free oil thicknesses in each of these plumes was 3.36 feet, 2.09 feet, and 0.49 feet (estimated), respectively.
- Most of the oil from Plume 13-AH and 13-ICI was comprised of a variably weathered heavy fuel oil #5 or #6 or crude oil. Some of these wells also contained mixtures of heavy fuel/crude oil with different amounts of variously weathered diesel fuel #2/fuel oil #2 and various amounts of unspecified gasoline range products. Oil from the northeastern portion of Plume 13-ICI B was distinct because it contained predominantly suspected PAH compounds, which suggests that the material was derived from a non-petroleum source. This area is clearly heterogeneous and has a complex history of multiple product releases in many areas. The viscosity of the oil was relatively low.
- Plume 13-AH contained mixtures of heavy fuel/crude oil with different amounts of variously weathered diesel fuel #2/fuel oil #2 and various amounts of the unspecified gasoline range product(s). Within Plume 13-ICI A, the NAPL samples from the southern and central portions of the plume are all chemically similar in that they are comprised of a mixture of gasoline, diesel and residual range organics. Specifically, they appear to represent mixtures of (1) a light petroleum product (gasoline?), (2) a diesel fuel oil #2, and (3) a minor amount of a "background" heavy fuel/crude oil. The degree of mixing among these three products is fairly comparable. The NAPL samples from the northern portion of Plume 13-ICI A are also chemically similar and are each comprised of moderately to-severely weathered heavy fuel oil or crude oil. There are no GC fingerprint data available for the main Plume 13-ICI B, however, based on visual similarity of the oil (dark brown-black with a relatively high viscosity), and ground water flow directions, this plume is believed to be related to the oil found in Plume 11, across Avenue J. At Plume 13-ICI C, the oil is a heavy, crude oil type.

Free Oil Recovery Design data

Plume 13-AH

- At Plume 13-AH, free oil recovery is not practicable at this time, because recovery rates were less than 0.1 gpm cut-off criteria. However, conceptual recovery methods that would be evaluated although yield rates are expected to be less than this cut-off criteria include sustained pumping using either skimming, total dual fluids pumping and vacuum enhanced pumping. Because this plume partially straddles a groundwater divide, pumping wells would need to be placed on both sides of the divide. However, the recovery wells would be concentrated in the eastern portion of the plume (where there is currently one existing well, AHFMW1) because most of the plume occurs on the east side of the divide.

- Near the Main Building, an alternative for remediation of this plume would be to construct a collection trench/drain on the western and southern sides of the Main Building. This collection system would be downgradient of the majority of Plume 13-AH.

Plume 13-ICI A

- At Plume 13-ICI A, the conceptual free oil recovery options include: 1) active skimming and total dual fluids pumping of free oil from vertical wells and, 2) possibly the use of an interceptor trench along the property boundary to the north. Plume 13-ICI A is outside the area of tidal influence. The array of recovery wells would include the two existing permanent wells (ICIMW2 and ICIMW3) in the south-central and central portions of the plume, but additional recovery wells would have to be added within the plume. An interceptor trench could be used at selected site boundaries.
- In the southern portion of Plume 13-ICI A (in the A Hill Tank Farm), free oil recovery using sustained skimming, total fluids or vacuum enhanced pumping from vertical wells is not practicable using the 0.1 gpm recovery rate cut-off. However, if lower recovery rates are considered, these methods could conceptually be implemented.

Plume 13-ICI B

- At Plume 13-ICI B, free oil recovery is not practicable at this time, because recovery rates are not expected to be close to the 0.1 gpm cut-off criteria. However, conceptual recovery methods that would be evaluated, although yield rates are expected to be less than this cut-off criteria, include skimming, and possibly vacuum enhanced pumping. An interceptor trench could be used at the site boundary along Avenue J. While this plume is believed to be connected to Plume 11, the interceptor trench at Plume 11 does not extend across Avenue J onto the ICI site, so a separate recovery system would be needed.

Plume 13-ICI C

- At Plume 13-ICI C, free oil recovery is not practicable at this time, because recovery rates are many orders of magnitude lower than the 0.1 gpm cut-off criteria. However, conceptual recovery methods that would be evaluated, even though yield rates are expected to be less than this cut-off criteria, include intermittent oil skimming, and containment.

1.2.10 Plume 14

Free Oil Delineation

- Plume 14 exists within the Lube Oil Area. The apparent thickness plume is elongate and trends in a north-south direction. The southeastern edge of the apparent thickness plume is approximately 120 feet from the boundary of the Exxon property. The maximum apparent free oil thickness was 6.63 feet, which was measured in the extreme northern portion of the plume, however, most of the plume is characterized by a thickness of less than 1 foot.
- The true thickness plume was depicted with an exaggeration ratio of 6. Using this ratio, the true free oil thickness plume is comprised of two areas with a thickness greater than 0.1 feet, one at the north end of the plume and another at the southern end. The maximum true free oil thickness in this plume was 1.11 feet.

- The oil from the northern, central and southern ends of Plume 14 are different. The northern end is characterized by a moderately weathered crude oil mixed with a gasoline range product(s). Farther south, the oil contained mixtures of gasoline range and diesel range products. Oil from the southern end of Plume 14 was comprised exclusively of severely weathered diesel fuel #2/fuel oil #2. The viscosity of the oil was relatively low.

Free Oil Recovery Design Data

- Free oil recovery at the two areas of Plume 14 where the true thickness is greater than 0.1 feet is not practicable at this time, because recovery rates were less than the 0.1 gpm cut-off criteria. However, conceptual recovery methods will be evaluated although yield rates are expected to be less than 0.1 gpm.

1.2.11 Plumes 15, 16, and 16A

Free Oil Delineation

- Plume 15 is located in the northern portion of the Platty Kill Canal Area, near a large stockpile of soil and construction debris. The apparent oil thickness plume is elongate and extends into the northwestern portion of the Lube Oil Area. The western end of this plume extends at least to the edge of the IMTT property and a small portion of the plume is interpreted to extend onto this property. The maximum apparent free oil thickness was 1.75 feet.
- At Plume 15, the true oil thickness plume was depicted using an exaggeration ratio of 4. The maximum true free oil thicknesses was 0.44 feet.
- Plume 16 exists in the central portion of the Platty Kill Canal Area. The plume is irregularly shaped and the width is variable. The Platty Kill Canal is the only downgradient receptor. The maximum apparent free oil thickness 3.23 feet.
- At Plume 16, the true oil thickness was depicted using an exaggeration ratio of 3.5. The maximum true free oil thicknesses in Plume 16 was 0.92 feet.
- Plume 16a exists in the central portion of the Platty Kill Canal Area immediately northeast of the Canal, within the confined groundwater zone. The apparent thickness plume is elongate and the maximum free oil apparent thickness was 10.09 feet.
- At Plume 16a, the true free oil thickness was not determined because the plume occurs in a confined groundwater zone. However, it is likely that the exaggeration in the monitoring wells is significant, given that the wells would tend to act as collection points for the oil trapped under the peat/silt layer.
- The oil within Plumes 15, 16, and 16a were all distinct from one another; the only exception was that one sample from Plume 15 and one from Plume 16 were virtually identical. The fact that the oils within the individual plumes were distinct argues for multiple sources within each plume, and that the free oil plumes may also be discontinuous. Recovery of free oil from Plume 15 will need to consider the heavy character of these oils, as the mobility of these heavy products is probably limited. The viscosity of the oils was moderate to high.

Free Oil Recovery Design Data

Plume 15

- At Plume 15, Exxon monitors free oil thickness and vacuums out product (and water) from well GMMW12 twice a week.
- At Plume 15, free oil recovery is not practicable at this time. A combination of factors make the recovery of free oil at Plume 15 not practicable. First, sustained recovery of free oil could not be achieved. Second, the GC fingerprint results indicated that the heavy character of these oils probably limits their mobility in the subsurface (the viscosity of the oils was relatively high). Third, the oil occurs over a relatively large area with only one central area of thicker oil, which has a true thickness of less than 0.5 feet. Therefore, a reasonable conceptual approach for this plume is remediation through natural or *in-situ* biodegradation with monitoring, and possibly intermittent skimming of oil from the central location of the plume.

Plume 16

- At Plume 16, Exxon currently monitors free oil thickness and vacuums out product (and water) from well EB19 twice a week.
- At Plume 16, sustained free oil recovery is not practicable at this time. Similarly to Plume 15, a combination of factors make the recovery of free oil in vertical pumping wells at Plume 16 not practicable. First, no sustained free oil recovery could be achieved during the pump testing. Second, the GC fingerprint results indicated that the heavy character of these oils probably limits their mobility in the subsurface (the viscosities were relatively high). Therefore, a conceptual remedial strategy would be to use intermittent free oil skimming from wells installed in the horseshoe shaped true thickness plume.
- An additional conceptual alternative is to use a small recovery trench installed on the upgradient side of the Platty Kill Canal retaining wall to capture oil that might otherwise migrate to the Canal. A recovery trench system would have to account for tidal effects on groundwater/free oil levels in the formation.

Plume 16A

- At Plume 16A, Exxon currently monitors free oil thickness and vacuums out product (and water) from wells PKMW11, PKMW12, and PKMW14 twice a week.
- At Plume 16A, which occurs in the confined groundwater zone, sustained free oil recovery is not practicable because recovery rates were less than 0.1 gpm cut-off criteria. However, conceptual recovery methods that would yield rates less than this cut-off criteria include intermittent oil skimming using large diameter wells. Recovery of free oil from Plume 16a in the confined zone has an added advantage over recovery in the unconfined zone in that the wells, which are screened in the confined zone, act as natural collection areas for the oil (i.e., the oil preferentially collects in these wells). Several additional recovery wells will need to be added in the central and southern portions of the plume because the existing wells are located only within the northern portion of the plume.

1.2.12 Plume 17

Free Oil Delineation

- Plume 17 is located in the Helipad Area. The Kill Van Kull Waterway is the only potential off-site downgradient property. The apparent thickness plume is irregularly-shaped and trends in a roughly northeast-southwest direction in the Helipad Area. The maximum apparent free oil thickness was 3.50 feet.
- An exaggeration ratio of 6 was used to depict the true thickness plume, which consists of two separate areas where free oil is greater than 0.1 feet. The maximum true free oil thicknesses in this plume was 0.58 feet.
- The oil from Plume 17 contain mixtures of lube oil with a "background" weathered crude oil. The predominantly heavy nature of these oils will minimize their potential to migrate into the subsurface, which is important given the proximity of the plume to the Kill Van Kull Waterway and Pier 1. The viscosity of the oil was moderate to high.

Free Oil Recovery Design Data

- At Plume 17, sustained free oil recovery is not practicable because recovery rates were significantly less than 0.1 gpm cut-off criteria. Also, the oil viscosity is fairly high at this plume. However, conceptual recovery methods will be evaluated for practicability. An arc-shaped collection trench/drain on the downgradient side of Plume 17 will be evaluated for effectiveness for capturing the free oil in the plume; this trench would have to extend far enough on both ends to account for the divergent flow affects produced by the groundwater mound that extends into the Helipad area. The need for multi-level collection pipes needs to be considered because tidal fluctuations in the Kill Van Kull Waterway effect groundwater levels. Also, the deteriorated condition of the eastern bulkhead wall should be considered. This collection trench could be tied into the West Side Treatment plant.

1.2.13 Outlier Plume

Free Oil Delineation

- The Outlier Plume is located south of Plume 16 in the Platty Kill Canal Area. The Platty Kill Canal is the only potential off-site downgradient property. The apparent thickness plume is roughly circular in shape and the maximum apparent free oil thickness was 1.11 feet.
- An exaggeration ratio of 6 was used to depict the true thickness plume. The maximum true free oil thicknesses in this plume was 0.19 feet.

Free Oil Recovery Design Data

- At the Outlier Plume, free oil recovery is not practicable at this time, given that the maximum true free oil thickness is 0.19 feet. Therefore, a reasonable conceptual approach for this plume is remediation through natural or *in-situ* biodegradation with monitoring, and possibly intermittent skimming of oil from wells in the plume.

Table 1-1

Summary of Pertinent Information from FORP Field Investigation

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Plume No.	Area	Ground water Zone	Maximum Apparent Free Oil Thickness	Maximum True Free Oil Thickness	Ratio of Apparent to True Free Oil Thickness	Tidal Area	Sustained Oil Recovery Rate During Pump Test			Was 0.1 gpm Sustained Oil Recovery Rate Criteria Met?	Maximum Radius of Groundwater Influence for TF Test	Range of Oil Viscosity	Types of Oil Present in Plume	Existing Free Oil Recovery System		Conceptual Free Oil Recovery Strategies For Further Evaluation
			(feet)	(feet)			SK Test (gpm)	TF Test (gpm)	VE Test (gpm)					Type	Operational	
1	Pier 7	Unconfined	4.31	1.08	4.0	Yes	0.100	0.025	0.250	Yes	NA	2.7 - 57.0	Weathered diesel range products, gasoline.	Total fluids pumping from Sheri 3 horizontal drain system. Total fluids pumping from EBR11.	Yes	Use sustained free oil SK or VE pumping from recovery wells in eastern portion of plume. Other conceptual strategies include 1) extend Sheri 3 drain collection system to western portion of plume.
2	Pier 6	Unconfined	0.49	0.14	3.5	Yes	0.069	Sheen	Sheen	No	> 50	10.3	Severely weathered automotive gasoline or kerosene, Jet A, JP-1 or JP-5.	Recovery wells exist on-site; 1 well is within the plume area.	No	Sustained recovery appears not practicable at this time. Other conceptual methods include sustained free oil SK in vertical recovery wells.
3	Pier 6	Unconfined	2.11	0.60	3.5	Yes	0.004	0.032	0.024	No	5 - 40	3.8 - 3.9	Severely weathered automotive gasoline or kerosene, Jet A, JP-1 or JP-5; one area of middle to heavy distillate fuel and or crude oil.	Recovery wells exist on-site; 2 wells are within the plume area.	No	Sustained recovery appears not practicable at this time. Other conceptual methods include TF pumping or VE pumping in vertical recovery wells.
5	General Tank Field	Unconfined	0.24	0.04	6.0	No	NA	NA	NA	NA	NA	NA	NA	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include <i>in-situ</i> bioremediation with long term monitoring because there is no discernible/recoverable free oil.
6	General Tank Field	Unconfined	7.67	1.28	6.0	No	0.000	0.010	0.030	No	> 50	4.7 - 24.0	Moderately degraded diesel fuel #2, fuel oil #2, automotive gasoline, kerosene, petroleum naphtha	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include 1) extend Sheri 3 horizontal drain oil collection system; 2) TF or VE pumping in vertical wells.
7-AV	Av Gas	Unconfined	9.91	1.65	6.0	No	0.05	0.920	NA	Yes	10 - 50	1.9 - 52.3	Moderately weathered diesel fuel #1, automotive gasoline, aromatic solvents (xylenes), fuel oil #2, lube oil, asphalt products, crude oil	Interceptor Trench (which provides partial coverage)	Yes	Use existing Interceptor Trench east to address western lobe of plume. Extend Trench to address northern portion of eastern lobe of plume. Conceptually consider using TF pumping in central and southern portions of eastern lobe of plume.
7-DT	Domestic Trade	Unconfined	7.41	1.85	4.0	No	0.030	0.020	0.070	No	15 - 50	2.6 - 3.2	Moderately weathered diesel fuel #2, fuel oil #2, mixed with unspecified gasoline range product	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include VE pumping from vertical wells (TF pumping is less effective than VE pumping.)
8/9	Exxon Chemicals (Utilities)	Unconfined	4.05	0.68	6.0	No	0.000	0.014	0.035	No	10 - 50	1.6 - 36.1	Mixtures of different types of oil. Diesel fuel #2, fuel oil #2, aromatic solvents (xylenes), lube oil, asphalt products, crude oil, automotive gasoline	None	NA	Sustained recovery appears not practicable at this time. Other conceptual remedial methods include TF or VE pumping from vertical recovery wells. At boundary of Exxon property consider use of interceptor trench to prevent off-site migration of plume.
10	No. 3 Tank Field	Unconfined	8.33	1.67	5.0	No	0.120	0.300	0.250	Yes	10 - 50	2.0 - 19.7	Moderately weathered diesel fuel #2, fuel oil #2, lube oil, asphalt products, unspecified gasoline product	None	NA	Use sustained free oil SK, TF or VE pumping from vertical wells. Consider use of interceptor trench along southern boundary of site to prevent off-site migration of oil.
11	Main Building	Unconfined	0.90	0.15	6.0	No	NA	NA	NA	NA	NA	2.7 - 29.9	Moderately to severely weathered heavy fuel oil product (fuel oil #5 or #6), crude oil	Interceptor Trench	Yes	Use existing Interceptor Trench
12	No. 2 Tank Field and Main Building	Unconfined	3.31	0.55	6.0	No	NA	NA	NA	NA	NA	5.3 - 8.5	Slightly weathered diesel fuel or diesel fuel #2, fuel oil #2 (within plume) unspecified gasoline range product	Interceptor Trench	Yes	Use existing Interceptor Trench
13-AH	A Hill Tank Field	Unconfined	9.55	1.91	5.0	No	0.040	0.030	0.090	No	10 - 50	3.2 - 7.7	Moderately weathered heavy fuel oil product, diesel fuel #2, fuel oil #2 mixed with heavy fuel oils (#5 and #6) or crude oil, automotive gasoline, crude oil.	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include free oil SK, TF or VE pumping from vertical wells or trenching.

Table 1-1

Summary of Pertinent Information from FORP Field Investigation

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Plume No.	Area	Ground water Zone	Maximum Apparent Free Oil Thickness	Maximum True Free Oil Thickness	Ratio of Apparent to True Free Oil Thickness	Tidal Area	Sustained Oil Recovery Rate During Pump Test			Was 0.1 gpm Sustained Oil Recovery Rate Criteria Met?	Maximum Radius of Groundwater Influence for TF Test	Range of Oil Viscosity	Types of Oil Present in Plume	Existing Free Oil Recovery System		Conceptual Free Oil Recovery Strategies For Further Evaluation
			(feet)	(feet)			SK Test (gpm)	TF Test (gpm)	VE Test (gpm)					Type	Operational	
13-ICI A	ICI Property (mostly off-site)	Unconfined	10.08	3.36	3.0	No	0.250	0.100	NA	Yes	10 - 50	1.6 - 8.7	Southern and central portion: mixture of light petroleum gasoline, diesel fuel oil #2, and minor amount of a "background" heavy fuel/crude oil. Northern portion: moderately to severely weathered heavy fuel oil or crude oil.	None	NA	Use sustained SK or TF recovery in central/southern portions of the plume. An interceptor trench could be used at selected site boundaries. In southern portion of plume (A-Hill Tank Field) conceptual methods include sustained SK, TF or VE pumping.
13-ICI B	ICI Property (off-site)	Unconfined	4.17	2.09	2.0	No	0.0023 (average based on data from two build-down tests)	NA	NA	No	NA	NA	No GC fingerprint data available. Based on visual inspection the oil is dark brown-black and has a relatively high viscosity.	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include the use of intermittent skimming or vacuum enhanced pumping. An interceptor trench could be used at the site boundary along Avenue J.
13-ICI C	ICI Property (off-site)	Unconfined	0.97	0.49	2.0	No	0.00007	NA	NA	No	NA	NA	GC fingerprint chromatograms do not have laboratory interpretations, but, the oil appears to be a severely weathered fuel oil or heavy crude oil with high viscosity.	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include the use of intermittent free oil skimming and possibly containment.
14	Lube Oil Area	Unconfined	6.63	1.11	6.0	No	0.004	0.050	0.040	No	10 - 50	2.0 - 8.0	Moderately weathered crude oil mixed with gasoline range product; mixture of diesel and gasoline range products; severely weathered fuel #2/ fuel oil #2.	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include TF or VE pumping from vertical wells (especially in northern portion of plume).
15	Platty Kill Canal	Unconfined	1.75	0.44	4.0	No	0.000	0.000	0.000	No	> 50	26.1 - 603	Severely weathered crude oil, unspecified gasoline range product; mid-range lube oil.	None	NA	Sustained recovery appears not practicable because there is no discernible/recoverable free oil. Other conceptual methods include <i>in-situ</i> bioremediation with long term monitoring, and possible intermittent free oil SK from selected wells.
16	Platty Kill Canal	Unconfined	3.23	0.92	3.5	Yes	0.000	0.000	0.000	No	10 - 50	16.7 - 77.5	Mid-range lube oil	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include use of collection trench along Platty Kill Canal to prevent migration of oil to the Canal.
16a	Platty Kill Canal	Confined	10.09	NA	NA	Yes	0.024	0.051	NA	No	NA	7.1 - 36.3	Moderately weathered crude oil or heavy fuel oils, minor gasoline range products	None	NA	Sustained recovery appears not practicable at this time. Other conceptual methods include intermittent free oil SK in large diameter wells (free oil would tend to preferentially flow into these confined zone wells).
17	Helipad	Unconfined	3.50	0.58	6.0	Yes	0.000	0.000	0.000	No	10 - 50	11.5 - 397.7	Mixtures of lube oil with a "background" weathered crude oil.	Recovery wells exist on-site; 4 wells are within the plume area	No	Sustained recovery appears not practicable at this time. Other conceptual methods include use of interceptor/recovery trench on the downgradient side of plume. The trench would have to consider tidal fluctuations of water/oil levels.
Outlier	Platty Kill Canal	Unconfined	1.11	0.19	6.0	No	NA	NA	NA	NA	NA	NA	NA	None	NA	Sustained free oil recovery is not practicable at this time. No discernible/recoverable free oil. A conceptual method includes <i>in-situ</i> bioremediation with long term monitoring.

Notes:

Pump test abbreviations: SK = Skimmer; TF = Total Fluids; VE = Vacuum Enhanced.

NA = Not Available

If, under "Conceptual Free Oil Recovery Strategies", the sustained recovery appears not practicable, the pumping scenarios considered as other "conceptual" remedial methods would have oil recovery rates that are less than the 0.1 gpm cut-off criteria.

Table I-2

Grain Size Analyses Results

Free Oil Recovery Project
Bayonne, New Jersey

Plume:	1	2	3	5/6	7 A.G.	8/9	8/9	8/9	10	11	12
Sample No.:	PR7SB1-4	PR6SB2-10	PR6SB1-6	GTFTMW4-6	TRHSB1-14	ECATMW7-10	ECATMW6-12	ECUSB1-8	3TFSB1-6	TRHSB3-3	TRHSB2-12
Depth:	4.0 - 5.7	10.0 - 10.6	6.0 - 6.5	6.0 - 7.4	14.0 - 15.0	10 -	12 -	8 -	6 -	3 -	12 -
Soil Grain Size											
% Coarse Gravel	14.03	3.21	5.01	1.22	0.29	0	3.25	8.34	1.44	0	1.07
% Fine Gravel	11.02	9	20.55	31.34	13.23	26.87	16.88	21.82	3.55	22.74	7.71
% Coarse Sand	8.89	31.53	22.19	17.76	7.61	20.15	7.78	7.22	2.67	26.02	8.63
% Medium Sand	26.29	26.81	18.71	22.35	9.43	19.29	11.39	9.25	7.58	19.88	13.29
% Fine Sand	36.06	25.95	23.19	18.61	50.92	24.04	24.67	21.93	66.86	21.26	36.53
% Fines	3.71	3.5	10.35	8.72	18.52	9.64	36.03	31.44	17.9	10.11	32.77
Total	100	100	100	100	100	99.99	100	100	100	100.01	100
% Fine Sand & Fines	40	29	34	27	69	34	61	53	85	31	69

Plume:	13AH	13ICI A	14	15	16	17	17	17	Outlier	Outlier	Outlier
Sample No.:	AHFSB1-6	ICIMW1	LUBSB1-8	PKCMW1T-6	PKCMW2T-4	HPISB1-4	HPIMW1T-7	HPITOW2-5	HP1TMW9-2	HP1TMW9-8	HP1TMW9-10
Depth:	6 -	5 - 7	8 -	6 -	4 -	4 -	7 -	5 -	2 -	8 -	10 -
Soil Grain Size		(see below)									
% Coarse Gravel	15.69	NA	9.97	1.53	2.75	1.13	0	5.41	8.98	0	0.49
% Fine Gravel	15.76	NA	9.84	10.97	16.84	27.58	24.28	15.51	23.66	9.12	5.42
% Coarse Sand	5.3	NA	8.25	15.61	13.62	23.09	12.19	10.97	9.74	6.16	4.06
% Medium Sand	6.78	NA	14.14	23.54	18.74	23.93	15.12	17.47	13.55	12.53	12.56
% Fine Sand	25.73	NA	33.43	32.82	40.68	14.11	21.68	22.55	34.41	59.56	69.02
% Fines	30.74	75.63	24.37	15.53	7.37	10.15	26.73	28.08	9.66	12.63	8.44
Total	100	100	100	100	100	99.99	100	99.99	100	100	99.99
% Fine Sand & Fines	56	>75.63	58	48	48	24	48	51	44	72	77

NA = not available

#200 sieve
wash,
24.37%
sand and
gravel

1.0 Summary

1.1 Introduction

Parsons Engineering Science, Inc. (Parsons ES) was retained by Exxon Company, USA (Exxon) to complete a free oil delineation program and to establish the most appropriate remedial design options suitable for free oil recovery at Exxon's former Bayonne Oil Terminal located in Bayonne, New Jersey (**Figure 1-1**). As part of the free oil delineation effort, Parsons prepared a Workplan titled, "Scope of Work - Field Investigation for Free Oil Recovery Delineation and Basic Design", which was submitted to NJDEP in May 1997. Parsons then implemented the field investigation pursuant to the Workplan during the summer of 1997. This report presents the findings and conclusions of the field investigation work, including final delineation of the free oil plumes at the site, and recommendations for design parameters for basic design of free oil recovery systems at various plume locations.

As background information, it should be noted that prior to Parsons ES's FORP field investigations, Exxon had prepared a Phase IA Remedial Investigation Report (Geraghty & Miller, 1995), pursuant to an Administrative Consent Order (ACO) issued by the New Jersey Department of Environmental Protection (NJDEP), dated November 27, 1991. Among the other findings presented in the Phase IA report, Exxon reported that there were 17 non-aqueous phase liquid (NAPL) plumes located across the site (**Figure 1-2**). Concurrently, an interim remedial measures (IRM) program for free oil recovery in 11 designated areas of the site, has been underway since the execution of the ACO (some of the NAPL recovery efforts actually predate the ACO). These NAPL IRMs are at various stages of the remedial process ranging from characterization and delineation to operation and maintenance. Through an agreement reached between NJDEP and Exxon (see letter from NJDEP dated March 29, 1996), it was agreed that Exxon would characterize, delineate, and remediate the NAPL site-wide prior to continuing the remedial investigation (RI) program. For ease of reference, the program to characterize, delineate, and remediate the NAPL site-wide will be referred to as the "Free Oil Recovery Project" (FORP) IRM in this report. The focus of the FORP IRM will be to design, construct and operate oil remediation systems in sensitive areas and in areas of major accumulations of oil.

The field investigation phase of the FORP was designed to complete the delineation of the free oil plumes through the installation of new temporary wells and permanent wells as needed, within the context of the focus of the FORP. As presented to the NJDEP, the FORP Workplan uses a 0.1-foot measured free oil apparent thickness as a criteria for defining plume boundaries. In addition, free oil was characterized using GC fingerprinting, VOA and viscosity analyses, and soil profile analyses were performed to evaluate suspected source areas. The free oil plumes were delineated using data from the new temporary wells, new and existing permanent wells, and from previously installed temporary wells; during the delineation, the reliability of certain existing wells (screen location, type, etc.) and related data from such wells was verified. Multiple rounds of measuring events were conducted within each plume to determine the apparent thickness and to evaluate potential impacts from tides. In addition, free oil recovery pump tests (skimmer, total dual fluids, and vacuum enhanced) were conducted within the plumes to evaluate the potential for free oil recovery. As presented to the NJDEP, the FORP Workplan uses 0.1 gpm as a reasonable lower cut-off criteria for an acceptable oil recovery rate. Lastly, two rounds of oil/water measurements were taken over the entire Bayonne facility to verify groundwater flow directions. Another round of measurements were taken at the ICI Americas site and this data provided supplemental data for the determine of groundwater flow directions.



SCALE
0 2000 FT

SOURCE: USGS JERSEY CITY QUADRANGLE 7.5 MINUTE SERIES, 1981



PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE



COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

DEPT ENVIRONMENTAL ENGINEERING

DWG NO

FIGURE 1-1
Site Location Map

SCALE 1 inch = 2000 feet

DATE February 1998

3.0 Groundwater Conditions in Central and Eastern Constable Hook

This section reviews the existing site hydrogeology, which was mainly established through previous investigations, but was confirmed in the borings performed as part of the FORP. Next, this section presents information on the distribution of groundwater within the hydrostratigraphic units, and groundwater flow directions and hydraulic gradients in the central and eastern parts of Constable Hook, which includes the Exxon/IMTT and ICI Americas Bayonne facilities. The field data was collected during the FORP field investigation. Areas of the site where the groundwater is influenced by the tides is also discussed. These results are compared to the 1994 groundwater map (Geraghty & Miller, 1995). The groundwater flow directions are important for the FORP, because they influence how the free oil plumes are depicted on the maps. And, most importantly, they establish approximate directions of free oil transport with reference to existing recovery systems (i.e., capture zones) and off-site boundaries.

3.1 Hydrogeologic Units and Groundwater Zones

Five hydrogeologic units have been identified at the site based on data from Geraghty & Miller (1995), Malcolm Pirnie (1998), and the FORP field investigation.

On the Exxon/IMTT site, there are three water-bearing units (shallow, intermediate, and deep), which are separated by two confining layers (upper and lower). The shallow water bearing unit is the most important because the oil was found predominantly in this unit.

The shallow water bearing unit consists of saturated fill deposits, and these deposits were encountered in nearly all of the FORP borings. The hydraulic characteristics of the fill are highly variable depending on the type of fill. However, the relatively thin saturated thickness and the variable lateral extent of more permeable fill results in limited groundwater withdrawal capacities. The base of this shallow water-bearing unit is most commonly defined by the upper confining unit, which consists of the meadow mat and underlying marsh silt and clay unit. The confining layer is nearly continuous, with only a few limited areas that allow for hydraulic connection between the saturated fill and the intermediate water bearing unit, which consists of a marsh/alluvial sand unit that overlies the till.

The lower confining layer at the site consists of the till unit (Geraghty & Miller, 1995). This dense, laterally continuous and thick layer of poorly sorted till effectively isolates the shallow and intermediate water-bearing units from the deep water-bearing unit. The deep water-bearing unit consists of an alluvial sand unit and, to a lesser extent, underlying fractured bedrock (Geraghty & Miller, 1995).

On the ICI site, four main stratigraphic units were identified (Malcolm Pirnie, 1989). These are fill, marsh deposits, shallow alluvial deposits, till, and deep alluvial deposits. The fill unit extends across the entire ICI site. The marsh deposits (meadow mat) is not continuous at the site. The meadow mat occurs in areas that were once part of the low lying marsh that used to surround the topographic high on Constable Hook. The shallow alluvial deposits are believed to exist beneath the entire site (based on data from two borings) and it consists of a brown to reddish brown, fine to medium grained sand with various percentages of silt and gravel. The till unit is a dense, reddish brown deposit that consists of poorly sorted fine to medium grained sand with silt, clay and gravel. At two locations, a deep alluvial deposit was encountered below the till. It consisted of a well sorted reddish brown fine to medium grained sand.

3.2 FORP Site-Wide Groundwater Survey

A site-wide groundwater survey was performed to establish groundwater flow directions. Depth to water measurements were taken during two measuring events, one at the Exxon/IMTT site, which includes the

majority of the wells, and the other at the ICI site. At the Exxon/IMTT site, water levels were measured in monitoring wells screened in the shallow unconfined water bearing zone, and in confined zone wells at the Platty Kill Canal Area, during both low and high tides on September 10, 1997. At the ICI site, which is not tidally influenced, water levels were measured in the unconfined water bearing zone on November 6, 1998, however, in five ICI wells the data was collected on November 11th. Note that access to the ICI site was not permitted during the 1997 FORP field investigation. Therefore, while the majority of the elevations are based on data collected on one day, the map is actually a composite of two data sets, and represents "pseudo-synoptic" ground water conditions in central and eastern Constable Hook.

In total, 182 shallow unconfined zone wells and 8 confined zone wells were measured during each of the tidal events at the Exxon/IMTT site, and 44 unconfined zone wells were measured at the ICI site. Groundwater elevations were established based on the depth to water data from the top of the PVC or steel casing at each well, and these elevations were corrected if free oil was present in the wells. The elevations in the wells were corrected using the following equation:

$$\text{Corrected Water Table Elevation} = \text{Water Table Elevation} + (\text{Specific Gravity}^* \times \text{Free Oil Thickness})$$

* average specific gravities for each plume ranged from 0.778 to 0.974.

The top of well casing elevations were established using the 1929 National Geodetic Vertical Datum (NGVD29) during the FORP and during previous investigations at the facility. NJDEP groundwater contour map reporting forms were completed for the unconfined groundwater map and for the confined zone groundwater map and these forms are included in **Appendix B**.

A mid-tide groundwater contour map was developed based on the low and high tide data. The mid-tide contours are believed to be more representative of the long-term direction of transport of free oil than the separate low and high tide contour maps (**Figure 3-1**). As a note, the high and low tide groundwater contour maps were very similar to the mid-tide map. Thus, the discussion below will focus on the mid-tide contour data.

The following highlights were obtained from the mid-tide groundwater contour map of the unconfined groundwater zone:

- In general, the groundwater contour map that was developed based on the FORP field investigation data is similar to the map presented in Geraghty & Miller (1995).
- Groundwater generally flows from a high in the northwestern corner of the site (near East 22nd Street) to the Upper New York Bay, the Kill Van Kull Waterway, and the Platty Kill Canal. This groundwater high is associated with a small regional topographic high that encompasses the middle portion of East 22nd Street and an adjoining tank field at an off-site location, IMTT, formerly Bayonne Industries, Inc. The presence of the groundwater high in this area is also supported by groundwater contours at the adjacent IMTT property (formerly Bayonne Industries facility) in November 1995 (ENSR, 1996).
- The most pronounced feature within the overall groundwater flow regime is a groundwater ridge/divide that is associated with the topographic high in the northwestern portion of the site; it extends from the A-Hill Tank Field to the western portion of the No. 2 Tank Field. On the north side of this divide groundwater flows to the northeast, and on the southern side it flows to the south and southwest. At the east end of this elongated mound groundwater flows predominantly to the east into the Asphalt and AV Gas Areas. This feature, referred to by Geraghty & Miller (1995) as a

"groundwater recharge ridge", is also depicted on the contour map developed by Geraghty & Miller (1995).

- The groundwater flow at the ICI site radiates from a high located in the south-central portion of the site, near East 22nd Street. Relative to this high, the ground water flow direction over most of the ICI site is predominantly to the north and east (**Figure 3-1**). A ground water divide extends from the high that exists in the south-central portion of the site. This divide runs through the central portion of the site and becomes less pronounced in the northern portion of the site, near the New Hook Access Road. In the northwestern portion of the site, in the location of the former storage lagoons, the water table is noticeably flat. In the western portion of the site, where flow is to the north, the hydraulic gradient is approximately 0.019 ft/ft. In the central portion of the site, in the location of the ground water divide, and in the southeastern portion of the site, the gradient is approximately the same 0.009 ft/ft.
- Another groundwater high exists within the central portion of the Lube Oil Area. Groundwater flow from this elongate, north-south trending mound is predominantly to the west, south, and southeast. This groundwater mound is also depicted on Geraghty & Miller's (1995) groundwater contour map.
- Groundwater contours in the Low Sulfur Tank Field Area (at Plume 4) exhibit influence from an active remediation system. At this location, an active vacuum enhanced, groundwater pumping remediation system depressed the groundwater table up to approximately 4 feet and created a cone of depression with a diameter between 500 feet and 700 feet.
- In the north-central portion of the site (at Plumes 11 and 12), the groundwater contours appear to be influenced by the Interceptor Trench because they indicate that groundwater flow is toward the Trench. Groundwater elevations at the western end of the Trench (near Plume 11), and in two wells installed in off-site locations north of Plume 12, indicate that the Trench is capturing groundwater on both sides.
- Groundwater gradients are generally steeper in the western and northwestern portions of the site (0.009 to 0.02) than in the eastern portion of the site (0.001 to 0.006), with the exception of those gradients associated with the groundwater depression pumping at the Low Sulfur Tank Field (0.01 to 0.02).

The following highlights were obtained from the mid-tide groundwater contour map of the confined groundwater zone at the Platty Kill Canal Area (**Figure 3-1**):

- Groundwater generally flows from the northeast to southwest toward the Platty Kill Canal in the confined zone in this area. However, in one well (PKMW12), which is 30 feet from the Platty Kill Canal, the mid-tide elevation of the water table was higher than it was in the groundwater zone to the east, suggesting that there may be a reversal flow near the Canal.
- The groundwater gradient is approximately 0.002 in the central portion of the Platty Kill Canal Area.

3.3 Tidal Effects on Groundwater Conditions

As noted above, water levels were measured in monitoring wells screened in the shallow unconfined water bearing zone, and in confined zone wells at the Platty Kill Canal Area, during both low and high tides on September 10, 1997. The measurements were made within approximately 1 hour on either side of the low and high tides, which occurred at 0837 and 1443 on this day, according to the Coast Guard

Tidal Chart "The Battery - September 1997 - Daylight Saving Time, Times and Heights of High and Low Waters."

The following highlights were obtained from the mid-tide groundwater contour map:

- Water level measurements at a surface water gauging station on Platty Kill Canal showed that the tidal variation was 3.61 feet.
- With the exception of the four shoreline areas discussed below, and a few miscellaneous locations away from shorelines, the groundwater elevations in shallow monitoring wells did not exhibit significant fluctuations during the tidal cycle. Tidal variations were also only found in the same four shoreline areas by Geraghty & Miller (1995).
- Shallow monitoring wells that exhibited a water level rise of greater than 0.1 foot during the rising tidal cycle on September 10, 1997 are located at shoreline areas. The four areas are as follows:
 1. Pier 7 Area - Tidal influences are generally limited to areas within 150 to 200 feet from Upper New York Bay. The maximum observed head change from low to high tide was 3.6 feet.
 2. Pier 6 Area - Tidal influences are generally limited to areas within 150 to 200 feet from Upper New York Bay. The maximum observed head change from low to high tide was 1.6 feet.
 3. Helipad Area - Tidal influences are generally limited to areas within 150 to 200 feet from Kill Van Kull Waterway. The maximum observed head change from low to high tide was 2.94 feet.
 4. Platty Kill Canal Area - Tidal influences in the unconfined groundwater zone are generally limited to areas within 100 to 150 feet from the Platty Kill Canal. The maximum observed head change from low to high tide was 2.1 feet. In the confined groundwater zone, tidal influences were measured up to 400 feet inland from Platty Kill Canal; the maximum observed head change was 1.09.
- The apparent free oil thicknesses in the wells that were influenced by the tide were generally thicker during low tide than during high tide; where appropriate, this should be considered for FORP design. Of the 190 wells measured for this program, 31 of the wells exhibited a tidal change of 0.1 feet or greater. The largest variation in apparent free oil thickness from low to high tide occurred in a well at Pier 6; the change was 1.55 feet. In the other 30 wells, the magnitude of the change of free oil thickness from low to high tide was generally less 0.5 feet.

Table 3-1
Ground Water Elevation Data for Exxon/IMTT Site

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL - LOW TIDE (ft)	DEPTH TO GROUND WATER - LOW TIDE (ft)	DEPTH TO OIL - HIGH TIDE (ft)	DEPTH TO GROUND WATER - HIGH TIDE (ft)	SPECIFIC GRAVITY OF OIL	CORRECTED LOW TIDE GROUND WATER ELEVATION (ft)	CORRECTED HIGH TIDE GROUND WATER ELEVATION (ft)	CORRECTED MID TIDE GROUND WATER ELEVATION (ft)	DATE
3TFTMW1	604013.77	662585.19	15.64	9.03	9.03	9.03	9.03	0.836	6.61	6.61	6.61	9/10/97
3TFTMW2	604107.00	662622.58	12.45	7.31	7.54	7.34	7.61	0.836	5.10	5.06	5.08	9/10/97
3TFTMW8	603887.15	662561.85	12.54	5.80	5.80	5.80	5.80	0.836	6.74	6.74	6.74	9/10/97
AHFMW1	602440.12	664735.53	17.73	10.69	14.49	10.54	14.78	0.820	6.35	6.43	6.39	9/10/97
AHFTMW10	602195.12	664899.15	14.70	5.56	5.56	5.52	5.52	0.820	9.14	9.18	9.16	9/10/97
AHFTMW6	602536.97	664675.23	17.49	10.51	13.89	10.48	13.91	0.820	6.37	6.39	6.38	9/10/97
AHFTMW7	602703.03	664903.72	16.95	NA	NA	14.83	14.83	0.820	NA	2.12	2.12	9/10/97
AHFTMW8	601930.57	664426.08	15.73	5.29	5.40	5.30	5.40	0.820	10.42	10.41	10.41	9/10/97
AHFTMW9	602378.10	664332.07	18.60	8.49	8.49	8.47	8.47	0.820	10.11	10.13	10.12	9/10/97
AHFTOW7	602445.10	664735.50	18.30	10.91	14.41	10.88	14.93	0.820	6.76	6.69	6.72	9/10/97
AHFTOW8	602450.09	664735.57	18.39	10.96	13.56	10.93	13.47	0.820	6.96	7.00	6.98	9/10/97
AHFTOW9	602488.42	664730.29	18.07	11.03	11.03	11.01	11.01	0.820	7.04	7.06	7.05	9/10/97
EB1	601891.90	662105.10	8.92	8.50	8.50	8.54	8.54	0.904	0.41	0.37	0.40	9/10/97
EB10	601847.00	662245.70	8.62	4.97	5.96	5.00	5.96	0.904	3.55	3.52	3.54	9/10/97
EB100	603559.65	664502.09	14.67	9.67	9.75	9.70	9.80	0.866	4.98	4.95	4.97	9/10/97
EB11	601891.40	662374.50	9.30	4.10	4.12	4.10	4.19	0.904	5.19	5.19	5.19	9/10/97
EB12	601824.60	662469.00	11.79	5.35	5.38	5.34	5.35	0.904	6.43	6.44	6.44	9/10/97
EB16	601515.80	662973.40	12.56	10.82	11.93	10.83	11.89	0.904	1.63	1.62	1.63	9/10/97
EB17	602070.80	663053.40	12.36	3.21	3.58	3.21	3.56	0.907	9.11	9.11	9.11	9/10/97
EB19	601172.30	663389.50	9.26	4.37	6.20	4.35	6.12	0.917	4.73	4.76	4.75	9/10/97
EB22	602041.00	664135.20	13.31	2.72	2.89	2.72	2.89	0.907	10.57	10.57	10.57	9/10/97
EB23	601930.90	664276.00	14.73	3.79	3.79	3.80	3.80	0.907	10.94	10.93	10.93	9/10/97
EB24	602157.90	664254.60	15.82	5.70	5.70	5.71	5.71	0.907	10.12	10.11	10.11	9/10/97
EB25	602131.90	664346.40	13.76	3.36	3.37	3.36	3.37	0.820	10.39	10.39	10.39	9/10/97
EB26	602092.92	664407.25	14.54	4.01	4.01	4.00	4.00	0.820	10.53	10.54	10.53	9/10/97
EB27	601828.00	664570.15	16.42	5.32	5.32	5.32	5.32	0.820	11.10	11.10	11.10	9/10/97
EB28	602158.99	664722.60	16.73	6.66	6.66	6.66	6.66	0.820	10.07	10.07	10.07	9/10/97
EB29	601947.71	665102.52	17.80	3.74	3.74	3.75	3.75	0.820	14.06	14.05	14.05	9/10/97
EB30	602177.50	665081.82	13.05	2.71	2.71	2.71	2.71	0.820	10.34	10.34	10.34	9/10/97
EB31	602532.02	664659.91	16.91	7.41	7.41	7.43	7.43	0.820	9.50	9.48	9.49	9/10/97

Table 3-1

Ground Water Elevation Data for Exxon/IMTT Site

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL - LOW TIDE (ft)	DEPTH TO GROUND WATER - LOW TIDE (ft)	DEPTH TO OIL - HIGH TIDE (ft)	DEPTH TO GROUND WATER - HIGH TIDE (ft)	SPECIFIC GRAVITY OF OIL	CORRECTED LOW TIDE GROUND WATER ELEVATION (ft)	CORRECTED HIGH TIDE GROUND WATER ELEVATION (ft)	CORRECTED MID TIDE GROUND WATER ELEVATION (ft)	DATE
EB33	602457.30	665395.90	11.05	9.09	9.09	9.11	9.11	0.874	1.96	1.94	1.95	9/10/97
EB34	602441.80	665391.40	12.84	8.75	9.41	8.72	9.31	0.874	4.01	4.04	4.02	9/10/97
EB35	602463.60	665422.00	10.62	7.32	7.32	7.35	7.35	0.874	3.30	3.27	3.28	9/10/97
EB36	602463.77	665471.77	9.60	5.62	5.66	5.64	5.72	0.874	3.97	3.94	3.96	9/10/97
EB4	602002.70	662107.80	9.01	8.94	8.99	9.10	9.10	0.904	0.07	-0.01	0.00	9/10/97
EB40	602495.30	665393.30	10.93	8.54	8.66	8.54	8.69	0.874	2.37	2.37	2.37	9/10/97
EB41	602562.42	665323.46	11.95	9.40	9.40	9.40	9.41	0.874	2.55	2.50	2.54	9/10/97
EB42	602627.30	665238.30	12.03	7.47	7.48	7.47	7.48	0.874	4.56	4.56	4.56	9/10/97
EB44	602792.10	665121.40	11.18	10.36	10.36	10.36	10.36	0.874	0.82	0.82	0.82	9/10/97
EB45	602869.70	664943.90	14.33	10.51	10.51	10.50	10.50	0.866	3.82	3.83	3.82	9/10/97
EB48	606270.40	664246.50	9.06	6.44	6.44	6.22	6.22	0.913	2.62	2.84	2.73	9/10/97
EB49	606268.00	664119.10	10.62	8.24	8.24	8.08	8.08	0.913	2.38	2.54	2.46	9/10/97
EB50	605964.80	664098.20	10.91	6.96	6.97	6.95	6.96	0.913	3.94	3.95	3.95	9/10/97
EB51	606079.80	664082.00	10.21	6.46	6.46	6.39	6.39	0.913	3.75	3.82	3.78	9/10/97
EB52	606207.90	664057.00	10.53	7.56	7.56	7.38	7.38	0.913	2.97	3.15	3.06	9/10/97
EB56	606231.10	663908.80	9.16	5.35	5.80	5.27	5.73	0.913	3.77	3.84	3.81	9/10/97
EB57	606196.40	663934.10	12.51	6.75	6.75	6.73	6.73	0.913	5.76	5.78	5.77	9/10/97
EB58	606340.60	663989.80	8.94	5.76	6.72	5.70	6.65	0.913	3.09	3.15	3.12	9/10/97
EB59	606415.30	663947.60	11.72	9.99	10.09	9.23	9.26	0.913	1.72	2.48	2.10	9/10/97
EB60R	606539.80	663926.10	11.37	11.29	11.31	7.93	7.93	0.913	0.08	3.44	1.75	9/10/97
EB61	606617.70	663929.20	11.69	9.85	9.85	9.80	9.80	0.913	1.84	1.89	1.86	9/10/97
EB62	606744.80	663916.70	12.41	12.44	13.36	8.85	9.27	0.913	-0.11	3.52	1.70	9/10/97
EB63	606860.50	663904.90	10.96	9.67	10.44	9.13	9.68	0.913	1.22	1.78	1.50	9/10/97
EB64	606339.00	663934.10	9.25	6.78	7.05	6.44	6.71	0.913	2.44	2.78	2.61	9/10/97
EB65	606419.70	663935.20	11.03	12.31	12.57	8.80	9.11	0.913	-1.30	2.20	0.45	9/10/97
EB66R	606545.00	663912.30	11.98	10.16	10.17	9.75	9.75	0.913	1.81	2.23	2.02	9/10/97
EB67	606619.00	663911.40	12.05	11.44	14.14	8.36	10.49	0.913	0.37	3.50	1.90	9/10/97
EB68	606745.10	663899.70	12.73	12.43	12.43	9.26	9.26	0.913	0.30	3.47	1.88	9/10/97
EB69	606829.30	663882.30	12.66	12.52	14.19	9.15	9.27	0.913	-0.01	3.49	1.74	9/10/97
EB7	602020.00	662180.90	8.87	9.11	9.11	9.13	9.13	0.904	-0.24	-0.26	-0.25	9/10/97

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Ground Water Elevation Data for Exxon/IMTT Site

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Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL - LOW TIDE (ft)	DEPTH TO GROUND WATER - LOW TIDE (ft)	DEPTH TO OIL - HIGH TIDE (ft)	DEPTH TO GROUND WATER - HIGH TIDE (ft)	SPECIFIC GRAVITY OF OIL	CORRECTED LOW TIDE GROUND WATER ELEVATION (ft)	CORRECTED HIGH TIDE GROUND WATER ELEVATION (ft)	CORRECTED MID TIDE GROUND WATER ELEVATION (ft)	DATE
EB71	606498.30	663445.40	12.15	10.32	10.32	10.35	10.35	0.852	1.83	1.80	1.81	9/10/97
EB72	606466.20	663298.30	12.27	10.45	11.14	10.39	11.05	0.852	1.71	1.78	1.75	9/10/97
EB74	606580.60	663358.40	12.01	10.18	10.68	10.32	10.68	0.852	1.76	1.63	1.69	9/10/97
EB75	605891.00	663347.30	13.47	6.93	6.93	6.92	6.92	0.923	6.53	6.55	6.54	9/10/97
EB76	605876.90	663499.00	11.88	7.56	7.57	7.56	8.23	0.923	4.32	4.26	4.29	9/10/97
EB79	605656.20	663616.70	12.34	9.51	12.74	9.70	12.73	0.923	2.58	2.40	2.49	9/10/97
EB8	602073.30	662164.00	8.12	7.85	7.85	4.91	4.91	0.904	0.27	3.21	1.74	9/10/97
EB82	606463.10	663812.20	10.70	9.44	9.44	9.41	9.41	0.913	1.26	1.29	1.27	9/10/97
EB85	606536.50	663653.20	9.81	7.65	7.65	7.66	7.66	0.903	2.16	2.15	2.15	9/10/97
EB87	603952.40	664394.30	9.03	2.41	2.41	2.41	2.41	0.922	6.62	6.62	6.62	9/10/97
EB88	603913.20	664322.90	8.28	1.91	1.91	1.92	1.92	0.922	6.37	6.36	6.36	9/10/97
EB91	603669.00	664446.40	9.66	5.84	5.84	5.83	5.83	0.922	3.82	3.83	3.82	9/10/97
EB92	603560.80	664511.10	9.10	5.67	5.79	5.66	5.79	0.866	3.41	3.42	3.41	9/10/97
EB93	603471.70	664557.60	9.76	6.44	6.44	6.44	6.44	0.866	3.32	3.32	3.32	9/10/97
EB94	603134.90	664770.80	8.19	5.88	5.89	5.84	5.86	0.866	2.30	2.34	2.33	9/10/97
EB95	603071.10	664837.30	8.15	5.94	6.01	5.94	5.99	0.866	2.20	2.20	2.20	9/10/97
EB96	603006.30	664916.10	8.00	6.49	6.59	6.49	6.59	0.866	1.49	1.49	1.49	9/10/97
EB97	602942.60	664999.30	7.30	6.01	6.12	6.01	6.09	0.866	1.27	1.27	1.27	9/10/97
EB98	602841.40	665063.10	10.79	9.24	9.25	9.26	9.27	0.866	1.54	1.52	1.53	9/10/97
EB99	603739.60	664416.20	9.26	3.44	3.44	3.45	3.45	0.922	5.82	5.81	5.81	9/10/97
EBR1	601651.90	662025.90	13.83	12.13	12.14	12.15	12.29	0.904	1.69	1.66	1.68	9/10/97
EBR10	606287.50	664083.70	9.30	7.10	7.17	7.11	7.33	0.913	2.19	2.17	2.18	9/10/97
EBR11	606285.80	663998.80	9.24	6.93	6.95	6.72	6.73	0.913	2.30	2.52	2.41	9/10/97
EBR12	606659.10	663557.10	10.04	8.55	9.04	7.68	8.17	0.903	1.44	2.31	1.87	9/10/97
EBR13	606632.90	663529.80	10.06	8.40	8.49	7.98	7.99	0.903	1.65	2.07	1.86	9/10/97
EBR14	606624.10	663490.10	10.05	8.30	8.30	7.98	7.98	0.903	1.75	2.07	1.91	9/10/97
EBR15	606530.60	663422.40	9.52	7.49	7.49	7.50	7.50	0.852	2.03	2.02	2.02	9/10/97
EBR18	606564.00	663360.50	11.44	9.77	9.90	9.71	9.76	0.852	1.65	1.72	1.68	9/10/97
EBR19	606482.50	663229.80	9.54	6.59	6.59	6.23	6.23	0.852	2.95	3.31	3.13	9/10/97
EBR2	601945.70	662035.00	8.93	NA	NA	6.94	7.01	0.904	NA	1.98	1.98	9/10/97

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Ground Water Elevation Data for Exxon/IMTT Site

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Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL - LOW TIDE (ft)	DEPTH TO GROUND WATER - LOW TIDE (ft)	DEPTH TO OIL - HIGH TIDE (ft)	DEPTH TO GROUND WATER - HIGH TIDE (ft)	SPECIFIC GRAVITY OF OIL	CORRECTED LOW TIDE GROUND WATER ELEVATION (ft)	CORRECTED HIGH TIDE GROUND WATER ELEVATION (ft)	CORRECTED MID TIDE GROUND WATER ELEVATION (ft)	DATE
EBR21	606315.70	663327.60	10.12	8.23	8.40	8.24	8.42	0.852	1.86	1.85	1.85	9/10/97
EBR23	606372.79	663194.53	10.10	6.00	6.00	6.22	6.22	0.852	4.10	3.88	3.99	9/10/97
EBR3	601934.30	662139.80	8.73	7.33	7.33	6.89	6.89	0.904	1.39	1.84	1.62	9/10/97
EBR4	602006.20	662215.70	8.58	6.59	8.39	6.70	8.49	0.904	1.81	1.70	1.76	9/10/97
EBR5	601996.20	662215.90	8.60	6.71	8.44	6.58	8.39	0.904	1.72	1.84	1.78	9/10/97
EBR6	601634.30	662204.20	10.38	5.88	7.09	5.89	7.11	0.904	4.38	4.37	4.37	9/10/97
EBR7	601778.70	662390.80	9.64	3.71	3.71	3.73	3.73	0.904	5.92	5.90	5.92	9/10/97
EBR8	601764.90	662251.90	9.46	4.90	6.74	4.90	6.71	0.904	4.38	4.38	4.38	9/10/97
GMMW1	602055.80	663731.10	9.81	3.93	4.48	3.93	4.46	0.907	5.82	5.83	5.82	9/10/97
GMMW10	605326.50	664568.40	8.88	4.95	5.18	4.92	5.40	0.923	3.91	3.92	3.91	9/10/97
GMMW11	604264.30	664625.70	13.83	6.84	6.89	6.88	6.92	0.922	6.98	6.94	6.96	9/10/97
GMMW11	604264.30	664625.70	11.58	6.84	6.89	6.88	6.92	0.922	4.73	4.69	4.71	9/10/97
GMMW12	601036.60	663746.00	13.76	6.86	6.87	6.89	6.98	0.923	6.89	6.86	6.88	9/10/97
GMMW13	602797.40	663274.70	11.85	4.55	4.55	4.45	4.45	0.862	7.30	7.40	7.35	9/10/97
GMMW14	604777.30	664068.50	9.30	4.04	4.04	4.04	4.04	0.923	5.26	5.26	5.26	9/10/97
GMMW15	606062.80	662985.30	9.45	6.73	6.75	6.80	6.82	0.852	2.72	2.64	2.68	9/10/97
GMMW16	604098.20	662762.96	11.61	5.68	13.41	5.64	13.45	0.836	4.66	4.68	4.67	9/10/97
GMMW17	604468.10	662881.50	10.91	5.88	5.88	5.85	5.85	0.836	5.03	5.06	5.04	9/10/97
GMMW18	603124.23	663262.05	15.15	6.98	8.86	6.97	8.81	0.862	7.91	7.92	7.91	9/10/97
GMMW19	602295.90	663203.80	11.12	5.79	5.80	5.80	5.81	0.907	5.32	5.31	5.32	9/10/97
GMMW2	602741.50	664207.20	17.44	4.12	4.12	4.15	4.15	0.866	13.31	13.28	13.30	9/10/97
GMMW20	604558.30	665059.70	8.22	4.99	4.99	4.97	4.97	0.923	3.23	3.25	3.24	9/10/97
GMMW25	601556.15	665028.51	34.58	18.56	18.56	18.53	18.53	0.820	16.02	16.05	16.03	9/10/97
GMMW26	602042.00	665049.19	16.40	5.01	6.33	4.83	6.27	0.820	11.15	11.31	11.23	9/10/97
GMMW27	601602.75	664417.37	16.87	4.48	4.70	4.47	4.68	0.820	12.35	12.36	12.35	9/10/97
GMMW28	602122.16	664617.82	14.03	5.62	6.10	5.60	6.07	0.820	8.32	8.34	8.33	9/10/97
GMMW3	603539.70	663880.90	15.15	9.58	10.09	9.53	10.05	0.922	5.53	5.57	5.55	9/10/97
GMMW4	604332.00	663635.90	9.72	5.46	5.46	5.46	5.46	0.922	4.26	4.26	4.26	9/10/97
GMMW5	603603.90	663262.10	9.26	1.43	1.43	1.43	1.43	0.862	7.83	7.83	7.83	9/10/97
GMMW5	603603.90	663262.10	9.35	1.43	1.43	1.43	1.43	0.862	7.92	7.92	7.92	9/10/97

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Ground Water Elevation Data for Exxon/IMTT Site

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Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL - LOW TIDE (ft)	DEPTH TO GROUND WATER - LOW TIDE (ft)	DEPTH TO OIL - HIGH TIDE (ft)	DEPTH TO GROUND WATER - HIGH TIDE (ft)	SPECIFIC GRAVITY OF OIL	CORRECTED LOW TIDE GROUND WATER ELEVATION (ft)	CORRECTED HIGH TIDE GROUND WATER ELEVATION (ft)	CORRECTED MID TIDE GROUND WATER ELEVATION (ft)	DATE
GMMW6	604682.30	663179.70	14.43	10.52	10.52	10.54	10.54	0.836	3.91	3.89	3.90	9/10/97
GMMW7	603839.44	662755.96	8.63	2.59	6.79	2.59	6.78	0.836	5.35	5.35	5.35	9/10/97
GMMW8	604895.70	665194.50	8.80	4.82	4.82	4.82	4.82	0.923	3.98	3.98	3.98	9/10/97
GMMW9	605755.50	664845.80	7.91	5.11	5.11	5.08	5.08	0.923	2.80	2.83	2.81	9/10/97
GTFMW1	605839.48	664161.21	7.93	4.27	5.65	4.27	5.67	0.923	3.55	3.55	3.55	9/10/97
GTFMW2	605324.67	664214.71	9.11	5.17	5.17	5.13	5.14	0.923	3.94	3.98	3.95	9/10/97
GTFMW3	605198.97	664940.06	11.42	7.38	7.42	7.38	7.42	0.923	4.03	4.03	4.03	9/10/97
GTFMW4	605454.30	664076.24	8.73	3.28	4.41	3.10	4.24	0.923	5.36	5.54	5.45	9/10/97
HP1MW1	601875.20	662393.61	12.10	8.00	8.14	8.03	8.18	0.904	4.08	4.05	4.07	9/10/97
ITMW1	604043.42	664191.81	13.69	7.50	17.10	7.48	17.12	0.922	5.44	5.45	5.44	9/10/97
ITMW2	603241.80	664644.80	15.28	11.74	14.65	11.74	14.76	0.866	3.15	3.13	3.14	9/10/97
ITMW3	603236.10	664624.00	15.50	11.99	14.38	11.97	14.38	0.866	3.18	3.20	3.19	9/10/97
ITMW4	602542.80	665288.40	10.20	6.68	7.05	6.66	6.94	0.874	3.47	3.50	3.48	9/10/97
ITMW5	602584.90	665373.40	8.53	4.50	4.53	4.51	4.52	0.874	4.02	4.01	4.02	9/10/97
ITMW6	602443.20	665410.60	11.76	7.62	7.62	7.59	7.59	0.874	4.14	4.17	4.15	9/10/97
LUBTMW4B	601995.21	663346.03	14.55	4.84	4.84	5.85	5.85	0.907	9.71	8.70	9.20	9/10/97
LUBTMW9	601991.80	663038.28	14.45	6.09	6.09	6.13	6.13	0.907	8.36	8.32	8.34	9/10/97
MW01	603064.00	663536.30	15.57	7.76	11.81	7.75	11.74	0.862	7.25	7.27	7.26	9/10/97
MW10	605619.40	664027.10	11.54	4.83	4.83	4.83	4.83	0.923	6.71	6.71	6.71	9/10/97
MW10S	601565.58	665605.15	NA*	NA*	NA*	NA*	NA*	NA*	15.43	15.43	15.43	1997
MW11	605819.80	663959.80	10.73	5.70	5.70	5.71	5.71	0.923	5.03	5.02	5.02	9/10/97
MW12	605399.70	663726.40	10.24	9.26	9.83	9.36	9.90	0.923	0.93	0.84	0.89	9/10/97
MW13	605503.40	663504.50	11.66	8.63	15.02	8.88	15.00	0.923	2.54	2.30	2.42	9/10/97
MW14	605573.30	663631.90	11.59	12.58	12.61	12.60	12.64	0.923	-0.99	-1.01	-1.00	9/10/97
MW2S	601306.78	665264.24	NA*	NA*	NA*	NA*	NA*	NA*	18.50	18.50	18.50	1997
MW3	605703.10	663417.90	12.06	7.14	16.10	7.20	16.21	0.923	4.23	4.16	4.19	9/10/97
MW3S	601851.25	665213.12	NA*	NA*	NA*	NA*	NA*	NA*	11.66	11.66	11.66	1997
MW4	605317.40	663393.60	9.10	3.65	3.74	3.65	3.75	0.923	5.44	5.44	5.44	9/10/97
MW4S	602318.94	665174.09	NA*	NA*	NA*	NA*	NA*	NA*	8.14	8.14	8.14	1997
MW5	605611.30	663336.70	9.94	4.72	4.72	4.73	4.73	0.923	5.22	5.21	5.21	9/10/97

Table 3-1
Ground Water Elevation Data for Exxon/IMTT Site

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL - LOW TIDE (ft)	DEPTH TO GROUND WATER - LOW TIDE (ft)	DEPTH TO OIL - HIGH TIDE (ft)	DEPTH TO GROUND WATER - HIGH TIDE (ft)	SPECIFIC GRAVITY OF OIL	CORRECTED LOW TIDE GROUND WATER ELEVATION (ft)	CORRECTED HIGH TIDE GROUND WATER ELEVATION (ft)	CORRECTED MID TIDE GROUND WATER ELEVATION (ft)	DATE
MW5S	602228.08	665646.71	NA*	NA*	NA*	NA*	NA*	NA*	7.08	7.08	7.08	1997
MW6	605714.30	663296.40	11.23	5.35	5.35	5.37	5.37	0.923	5.88	5.86	5.87	9/10/97
MW7	605179.20	663989.40	12.00	6.35	7.46	6.26	7.36	0.923	5.56	5.65	5.60	9/10/97
MW8	605759.90	663781.30	12.35	8.59	13.13	8.18	12.26	0.923	3.41	3.86	3.63	9/10/97
MW9	605010.30	663464.20	9.02	3.88	3.98	3.88	3.98	0.923	5.13	5.13	5.13	9/10/97
P7MW1	606591.80	663928.20	10.84	10.33	12.98	7.09	9.25	0.913	0.28	3.56	1.92	9/10/97
P7MW2	606490.50	663924.20	12.88	12.76	12.76	9.30	9.30	0.913	0.12	3.58	1.85	9/10/97
PKCMW1	601718.29	663872.64	12.29	5.50	6.03	5.48	5.97	0.923	6.75	6.77	6.76	9/10/97
PKCMW2	601379.42	663495.45	13.35	8.01	8.01	8.00	8.00	0.917	5.34	5.35	5.34	9/10/97
PKCMW3	601560.65	663878.82	11.78	10.31	10.70	10.31	10.71	0.923	1.43	1.43	1.43	9/10/97
PKCTMW12	601532.34	663549.87	12.47	11.10	14.61	10.90	14.63	0.885	0.96	1.14	1.05	9/10/97
PKCTMW13	601418.10	663334.61	12.64	10.95	10.95	10.58	10.58	0.885	1.69	2.06	1.87	9/10/97
PKCTMW15	601512.65	663181.71	12.55	10.04	10.29	10.02	10.27	0.917	2.48	2.50	2.49	9/10/97
PKCTMW2	600751.03	663794.49	14.71	5.78	5.78	5.73	5.73	0.917	8.93	8.98	8.95	9/10/97
PKCTMW4	601718.95	664000.98	15.49	9.70	11.38	NA	NA	0.923	5.66	NA	5.66	9/10/97
PKCTMW6	601554.71	663729.12	15.20	10.02	10.02	NA	NA	0.923	5.18	NA	5.18	9/10/97
PKCTOW4	601559.33	663873.49	14.97	NA	NA	9.70	11.37	0.923	NA	5.14	5.14	9/10/97
PKCTOW5	601559.05	663863.69	15.08	NA	NA	10.01	10.12	0.923	NA	5.06	5.06	9/10/97
PKCTOW6	601555.98	663839.33	14.49	NA	NA	10.01	10.01	0.923	NA	4.48	4.48	9/10/97
PKMW1	601198.80	663378.70	9.67	4.34	4.79	4.31	4.78	0.917	5.29	5.32	5.30	9/10/97
PKMW10	601147.90	663479.70	12.48	10.93	10.93	10.48	10.48	0.885	1.55	2.00	1.77	9/10/97
PKMW11	601221.50	663350.70	10.32	7.91	18.00	7.17	14.60	0.885	1.24	2.29	1.77	9/10/97
PKMW12	601417.87	663334.27	11.51	7.51	9.20	6.80	8.55	0.885	3.80	4.50	4.15	9/10/97
PKMW13	601204.90	663201.50	11.98	11.10	11.10	10.03	10.03	0.885	0.88	1.95	1.41	9/10/97
PKMW14	601429.85	663441.69	12.77	10.95	11.04	10.69	10.88	0.885	1.80	2.06	1.93	9/10/97
PKMW15	601308.60	663676.50	12.28	9.99	9.99	9.92	9.92	0.885	2.29	2.36	2.32	9/10/97
PKMW2	600989.10	663419.20	12.29	7.84	7.84	7.84	7.84	0.917	4.45	4.45	4.45	9/10/97
PKMW3	601133.50	663287.30	8.73	4.65	5.36	4.53	5.32	0.917	4.02	4.13	4.07	9/10/97
PKMW4	601214.00	663188.70	11.99	10.97	11.03	10.03	10.05	0.917	1.01	1.95	1.48	9/10/97
PKMW5	601197.40	662956.20	12.33	11.27	11.27	9.17	9.17	0.917	1.06	3.16	2.11	9/10/97

Table 3-1
Ground Water Elevation Data for Exxon/IMTT Site

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL - LOW TIDE (ft)	DEPTH TO GROUND WATER - LOW TIDE (ft)	DEPTH TO OIL - HIGH TIDE (ft)	DEPTH TO GROUND WATER - HIGH TIDE (ft)	SPECIFIC GRAVITY OF OIL	CORRECTED LOW TIDE GROUND WATER ELEVATION (ft)	CORRECTED HIGH TIDE GROUND WATER ELEVATION (ft)	CORRECTED MID TIDE GROUND WATER ELEVATION (ft)	DATE
PKMW6	601177.80	662807.00	12.28	10.02	10.02	10.10	10.10	0.917	2.26	2.18	2.22	9/10/97
PKMW7	601220.90	662676.60	13.46	11.25	11.25	11.27	11.27	0.917	2.21	2.19	2.20	9/10/97
PKMW8	601005.60	663668.40	13.29	6.19	6.19	6.18	6.18	0.923	7.10	7.11	7.10	9/10/97
PKMW9	601144.10	663493.60	12.72	5.98	5.98	5.99	5.99	0.917	6.74	6.73	6.73	9/10/97
PR6MW1	606594.12	663424.53	9.49	7.78	7.78	6.19	6.19	0.852	1.71	3.30	2.50	9/10/97
PR6MW2	606385.07	663309.01	11.38	7.68	8.45	7.65	8.42	0.852	3.58	3.61	3.60	9/10/97
TRHTMW16	603958.72	664405.70	13.70	NA	NA	7.15	7.15	0.922	NA	6.55	6.55	9/10/97
TRHTMW24	603706.48	664372.92	15.66	7.89	7.91	7.90	7.92	0.922	7.76	7.75	7.76	9/10/97
TRHTMW25	603210.66	664278.30	17.93	8.97	8.97	8.96	8.96	0.922	8.96	8.97	8.96	9/10/97
TRHTMW26	604175.40	664273.55	10.75	4.56	4.56	4.50	4.50	0.922	6.19	6.25	6.22	9/10/97

Note: Horizontal datum NAD83

Vertical datum NGVD29

NA - Not Available

NA* - Data not available. Elevations shown were provided by Malcolm Pirnie (1997); .

Table 3-2
Ground Water Elevation Data for ICI Americas Site

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL (ft)	DEPTH TO GROUND WATER (ft)	APPARENT OIL THICKNESS (ft)	SPECIFIC GRAVITY	CORRECTED GROUND WATER ELEVATION (ft)	DATE
EB28	602158.99	664722.60	16.73	7.80	7.80	0.00	0.778	8.93	11/6/98
EB29	601947.71	665102.52	17.80	4.38	4.38	0.00	0.778	13.42	11/6/98
EB30	602177.50	665081.82	13.05	3.23	3.23	0.00	0.778	9.82	11/6/98
EB33	602457.30	665395.90	11.05	9.08	9.08	0.00	0.923	1.97	11/6/98
EB34	602441.80	665391.40	12.84	9.00	9.27	0.27	0.923	3.82	11/6/98
EB35	602463.60	665422.00	10.62	7.56	7.56	0.00	0.923	3.06	11/6/98
EB36	602463.77	665471.77	9.60	6.00	6.01	0.01	0.923	3.60	11/6/98
EB40	602495.30	665393.30	10.93	8.56	8.68	0.12	0.923	2.36	11/6/98
EB41	602562.42	665323.46	11.95	9.40	9.57	0.17	0.923	2.54	11/6/98
EB42	602627.30	665238.30	12.03	7.47	7.47	0.00	0.923	4.56	11/6/98
EB44	602792.10	665121.40	11.18	10.47	10.47	0.00	0.923	0.71	11/6/98
GMMW25	601556.15	665028.51	34.58	20.51	20.51	0.00	0.778	14.07	11/6/98
GMMW26	602042.00	665049.19	16.40	5.65	6.90	1.25	0.778	10.47	11/6/98
GMMW29	601142.59	665155.08	NA	14.70	14.78	0.08	0.778	NA	11/6/98
ICIMW1	601311.59	665266.95	28.03	11.95	11.95	0.00	0.778	16.08	11/6/98
ICIMW2	601806.43	665219.58	27.21	15.61	25.54	9.93	0.778	9.40	11/6/98
ICIMW3	601792.50	665432.32	19.97	8.38	15.28	6.90	0.778	10.06	11/6/98
ICITMW1	601465.48	665472.84	23.30	9.42	10.60	1.18	0.778	13.62	11/6/98
ICITMW10	602166.53	665748.60	17.52	10.57	10.58	0.01	0.778	6.95	11/6/98
ICITMW11	601947.86	666012.56	13.65	7.21	7.21	0.00	0.778	6.44	11/6/98
ICITMW12	601747.88	666024.62	22.16	14.77	14.77	- 0.00	0.778	7.39	11/6/98
ICITMW13	601545.01	665839.89	23.28	14.76	15.18	0.42	0.778	8.43	11/6/98
ICITMW14	601457.99	665635.47	24.21	10.76	12.29	1.53	0.778	13.11	11/6/98
ICITMW15	601176.68	665502.78	21.51	8.15	8.15	0.00	0.778	13.36	11/6/98
ICITMW16	601032.94	665338.60	24.09	7.61	7.62	0.01	0.778	16.48	11/6/98
ICITMW17	601754.08	665060.67	26.10	16.23	17.14	0.91	0.778	9.67	11/11/98
ICITMW18	601040.71	665936.49	18.45	15.88	16.32	0.44	0.974	2.56	11/6/98
ICITMW19	601364.81	665960.80	23.49	20.92	21.14	0.22	0.974	2.56	11/6/98
ICITMW2	601635.91	665235.98	32.08	20.41	23.42	3.01	0.778	11.00	11/6/98
ICITMW20	601505.60	666023.59	21.17	18.56	19.20	0.64	0.974	2.59	11/6/98

Table 3-2
Ground Water Elevation Data for ICI Americas Site

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL (ft)	DEPTH TO GROUND WATER (ft)	APPARENT OIL THICKNESS (ft)	SPECIFIC GRAVITY	CORRECTED GROUND WATER ELEVATION (ft)	DATE
ICITMW21			NA	11.79	12.24	0.45	0.974	NA	11/11/98
ICITMW22			NA	12.48	12.48	0.00	0.974	NA	11/11/98
ICITMW23	601065.89	666565.38	11.51	8.93	8.93	0.00	0.974	2.58	11/11/98
ICITMW24	600962.79	666331.67	15.50	12.87	12.89	0.02	0.974	2.63	11/11/98
ICITMW25	601111.59	666319.29	14.00	11.36	11.36	0.00	0.974	2.64	11/11/98
ICITMW26	600916.09	665799.58	16.13	12.76	12.76	0.00	0.778	3.37	11/11/98
ICITMW3	602112.08	665185.88	24.44	14.69	14.69	0.00	0.778	9.75	11/6/98
ICITMW4	602173.29	665337.50	16.67	8.05	8.06	0.01	0.923	8.62	11/6/98
ICITMW5	602107.25	665527.04	18.77	8.13	8.13	0.00	0.778	10.64	11/6/98
ICITMW6	602317.25	665295.19	18.77	10.72	10.73	0.01	0.923	8.05	11/6/98
ICITMW7	602327.42	665396.40	14.15	9.55	10.20	0.65	0.923	4.55	11/6/98
ICITMW8	602342.85	665525.08	12.02	6.95	9.33	2.38	0.923	4.89	11/6/98
ICITMW9	602290.46	665612.95	13.11	6.92	6.92	0.00	0.923	6.19	11/6/98
ICITOW1	601322.68	665265.45	30.60	14.23	14.25	0.02	0.778	16.37	11/5/98
ICITOW2	601362.03	665272.07	30.50	13.74	13.75	0.01	0.778	16.76	11/5/98
ICITOW3	601821.83	665218.05	28.62	16.90	25.30	8.40	0.778	9.86	11/6/98
ICITOW4	601858.36	665209.61	28.47	16.77	25.25	8.48	0.778	9.82	11/6/98
ICITOW5	601792.49	665437.77	21.91	10.32	17.12	6.80	0.778	10.08	11/6/98
ICITOW6	601796.52	665443.53	21.39	9.73	17.38	7.65	0.778	9.96	11/6/98
ICITOW7	601797.89	665479.97	21.63	10.82	10.83	0.01	0.778	10.81	11/6/98
ITMW4	602542.80	665288.40	10.20	7.00	7.47	0.47	0.923	3.16	11/6/98
ITMW5	602584.90	665373.40	8.53	4.95	7.47	2.52	0.923	3.39	11/6/98
ITMW6	602443.20	665410.60	11.76	7.83	7.85	0.02	0.923	3.93	11/6/98
MW10S	601565.58	665605.15	23.93	10.80	11.37	0.57	0.778	13.00	11/6/98
MW11S	601747.17	665702.67	21.90	10.15	12.25	2.10	0.778	11.28	11/6/98
MW12D	601542.26	665836.09	23.02	14.49	14.50	0.00	0.778	8.53	11/6/98
MW1S	600785.45	665363.92	21.20	9.66	9.66	0.00	0.778	11.54	11/6/98
MW2S	601316.26	665261.74	28.18	10.89	14.33	3.44	0.778	16.53	11/6/98
MW3S	601851.25	665213.12	27.11	15.61	22.70	7.09	0.778	9.93	11/6/98
MW4S	602315.27	665183.57	11.45	4.47	5.36	0.89	0.923	6.91	11/6/98

Table 3-2
Ground Water Elevation Data for ICI Americas Site

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

WELL ID	EASTING	NORTHING	TOP OF PVC CASING (ft)	DEPTH TO OIL (ft)	DEPTH TO GROUND WATER (ft)	APPARENT OIL THICKNESS (ft)	SPECIFIC GRAVITY	CORRECTED GROUND WATER ELEVATION (ft)	DATE
MW5S	602255.14	665630.39	10.64	4.13	6.78	2.65	0.923	6.31	11/6/98
MW6S	601926.01	665981.72	17.38	10.13	12.52	2.39	0.778	6.72	11/6/98
MW7S	601576.06	666175.42	14.70	12.12	13.14	1.02	0.974	2.55	11/6/98
MW8D	601067.96	666475.31	12.44	10.60	10.61	0.01	0.974	1.84	11/6/98
MW8S	601068.67	666466.79	12.62	10.12	10.23	0.11	0.974	2.50	11/6/98
MW9S	601122.78	665968.37	18.52	15.95	16.40	0.45	0.974	2.56	11/6/98
PZ-1	601747.64	665363.89	20.94	9.66	10.27	0.61	0.778	11.14	11/6/98
PZ-2	601786.32	665389.66	19.87	7.84	8.67	0.83	0.778	11.85	11/6/98
PZ-3	601791.88	665421.95	20.00	8.33	14.70	6.37	0.778	10.26	11/6/98
PZ-4	602020.70	665814.20	16.30	7.55	8.72	1.17	0.778	8.49	11/6/98
PZ-5	602020.70	665804.36	16.82	8.10	8.73	0.63	0.778	8.58	11/6/98
PZ-6	601974.11	665771.96	18.50	8.48	11.13	2.65	0.778	9.43	11/6/98

Note: Horizontal datum NAD83
Vertical datum NGVD29

4.0 Plume 1 (Pier 7 Area)

4.1 Introduction

- Plume 1 is located at Pier 7 (**Figure 4-1** and **Figure 4-2**).
- The Pier 7 Area consists of an access road and a series of large pipe racks that generally flank the road. Oil transfer pipe lines connect Pier 7 to various tank fields. The southeastern portion of this area is occupied by the East Side Treatment Plant. Operations have not changed significantly since the 1940s.

4.2 Field Work

4.2.1 Free Oil Delineation Tasks

- Three temporary wells were installed at the Pier 7 Area (PR7TMW1 through PR7TMW3), as specified in the Workplan. NJDEP permits for the installation of these wells are included in Appendix C.
- As required by the Workplan, performed 1 soil boring and collected soil samples. Collected 2 vadose zone soil samples from PR7SB1 (2 less than specified in the Workplan due to the short length of the vadose zone at the location). Submitted these samples for analysis of FORP Workplan design parameters (% residual oil, % water, porosity, and bulk density). Also, one soil sample was collected within the oil zone at the water table for grain size analysis, as specified in the Workplan.
- Measured the apparent thickness of oil in all existing and proposed wells in the Pier 7 Area in accordance with the Workplan. In total, there were 19 measuring events.
- Performed free oil characterization on 3 samples, as indicated in the Workplan. The following analyses were performed: 1) GC fingerprinting: no samples were proposed because previous data exists; 2) VOA: EB62, EB65, and P7MW1; 3) viscosity: EB62, EB65, and P7MW1.

4.2.2 FORP Design Support Tasks

- As specified in the Workplan, performed 4 baildown tests in the Pier 7 Area (EB62, EB63, EB65 and P7MW1) (3 less than specified in the Workplan - the free oil thickness in several planned well locations was too thin for the test).
- Performed free oil recovery rate testing at 2 wells (PR7MW1 and EB65), the same number as specified in the Workplan.
- Prior to the test at PR7MW1 installed three observation wells at 5, 10, and 50 foot intervals from the well (PR7TOW1 through 3), as required by the Workplan. Performed free oil skimming test, total dual fluids pumping, and vacuum enhanced test at well PR7MW1 (2 more tests than specified in the Workplan).

Prior to the test at EB65, installed two observation wells at 5 and 10 foot intervals from the well (PR6TOW4 and 5), as required by the Workplan; existing well P7MW2 was used as the 50 foot observation well for this test. Performed total dual fluids pumping and vacuum enhanced pumping tests at well EB65 (1 more test than specified in the Workplan).

4.3 Description of Hydrogeology

The hydrogeology of the Pier 7 Area is summarized in the following bulleted items:

- The subsurface materials generally consist of fill to depths of approximately 26 feet below the ground surface (Raviv, 1995). The fill is generally composed of mostly fine to medium sand with a trace of silt and fine gravel. Other components of the fill included slag, wood, concrete and brick fragments.
- Two parallel, concrete, gantry walls exist at Pier 7 and act as retaining walls to support the Pier (Raviv, 1995). They extend from the ground surface to a depth of approximately 10 feet. The northern gantry wall is supported on piles and overlies a rock-filled wooden crib, and the southern gantry wall is supported by wooden piles (Raviv, 1995).
- In the vicinity where the thickest apparent free oil was measured at Plume 1, the subsurface material near the water table consisted of fine to medium sand with some silt and gravel.
- Grain size analysis of a soil sample collected near the water table (from 4.0 feet to 5.7 feet) in a boring (PR7SB1) that was performed adjacent to PR7MW1 indicated that the subsurface material contained approximately 4% silt and clay, 36% fine sand, and the remaining 60% was composed of coarser sand and gravel particles. The results of this analysis is consistent with the soil description for the interval near the water table in boring PR7SB1 given above.
- An unconfined groundwater zone is present in the fill on-site, and groundwater in the Pier 7 Area is generally between 5 feet and 10 feet below the ground surface and it is affected by the tides.
- The groundwater flow direction in the Pier 7 Area is predominantly to the northeast in the western portion of the area, and to the north in the eastern portion of the area, based on the mid-tide groundwater contour map (Figure 3-1). The hydraulic gradient ranges between 0.02 and 0.006.
- The unconfined groundwater zone is influenced by tidal fluctuations. The tidal influence affected 20 wells along the gantry walls at Pier 7. The maximum tidal variation in these wells was 3.6 feet. The tidal influence extended approximately 150 feet inland. At low tide, the elevation of the groundwater is below the bottom of the gantry wall (Raviv, 1995).

4.4 Free Oil Delineation Results

4.4.1 Apparent Free Oil Thickness

- Plume 1 is defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (Figure 4-1). A total of 33 wells were used for the delineation. The horizontal extent of the plume has been confirmed, and no further delineation of the free oil is required.
- Plume 1 is an elongated and somewhat irregular plume that extends along the entire length of the access road to Pier 7, parallel to the east-west trending gantry walls (Figure 4-1). The irregularities in the plume shape are likely due to the presence of the gantry walls (which have the potential to trap oil) and the complex nature of the fill and Pier 7 subsurface supports at the site. The maximum free oil thickness (4.31 feet) was measured in P7MW1 (Figure 4-1).
- The thickness of the free oil in the wells at Plume 1 is greater at low tide than at high tide, based on tidal measurements made during a tidal cycle (Appendix C).

4.4.2 True Free Oil Thickness

- The true free oil thickness at Plume 1 is comprised of four areas of free oil that are greater than 0.1 feet (**Figure 4-2**). The maximum true free oil thickness (1.08 feet) was at P7MW1.
- A conservative exaggeration ratio of 4, per EPA guidance, was used to derive the true thickness at Plume 1.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 1 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 4 baildown tests completed at the Pier 7 Area (**Table 4-1**). The subsurface material near the water table consisted of fine to medium sand with some silt and gravel. These descriptions correspond to a soil type of "sandy loam" using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type has a range of between approximately 2 and 4. The exaggeration ratios from 4 baildown tests ranged from 10.62 to 23.00 and the average exaggeration ratio was calculated to be 14.96. The ratios from the baildown tests are greater than the range reported in the EPA guidance for the soil types present. A combination of slow free oil recovery and a fluctuating water table due to the tides made it difficult to obtain good (i.e., typical) data for the tests. Thus, the interpretation of the exaggeration ratios was difficult, therefore, a conservative ratio based primarily on soil type was applied. An exaggeration ratio of 4, per EPA guidance, was used to derive the true thickness at Plume 1. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix C**.

4.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 1 are included on **Table 4-2**. The free oil characterizations are mostly from previous studies performed at the Pier 7 area.

- Free oil from five samples from wells within Plume 1 (EB52, EB58, EB60R, EB62, and EB69) are dominated by variously weathered diesel range product(s) (e.g., diesel fuel or fuel oil #2) (**Table 4-2**).
- A sample collected from the eastern portion of Plume 6 (GTFTMW15) was characterized as predominantly gasoline- and kerosene-range compounds (e.g., weathered automotive gasoline, Jet A, or kerosene), which is notably different from the samples collected from the body of Plume 1. These differences argue against a common source of the free oil in the western portion of Plume 6 with the oil in the other wells considered to be within Plume 1.
- The specific gravity of the free oil collected from nine wells (all from Raviv, 1995) ranged between 0.830 and 0.991 (**Table 4-2**).
- Analyses of soil samples collected along a vertical profile in a soil boring approximately 5 feet from well PR7MW1 showed that the percent of oil and grease in the vadose zone decreased with depth (**Table 4-3**). This profile suggests that oil may have been released at this location in the past. The laboratory data for percent oil is contained in **Appendix C**.

4.6 Potential Sources of Free Oil

Areas of potential sources of free oil at the Pier 7 Area include above ground storage tanks, oil/water separators, drum storage areas, sumps, the East Side Treatment Plant, loading and unloading areas, and storm sewers.

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the Pier 7 Area:

- There is only one documented release that occurred within the footprint of the current apparent thickness plume. The release was of 100 gallons of blend oil in 1991 (Geraghty & Miller, 1994).
- An oil/water separator was located within the east-central portion of Plume 1. The separator was approximately 180 feet long. Based on its physical association, it is a potential source of oil found in the plume

4.7 Free Oil Pump Testing Results

Free oil pump tests were performed at wells P7MW1 and EB65, which are located immediately north and south, respectively, of the southern gantry wall (Table 4-4). Both of these wells were within the area of tidal influence based on the two rounds of low and high tide water level measurements. Also, information on skimming and dual fluids free oil recovery rates for well P7MW1 was also obtained from tests previously performed by Raviv (1995). The detailed FORP results are contained in Appendix C.

- At well P7MW1, the average, sustained free oil recovery rate for the skimmer test was 0.1 gpm (Raviv, 1995) (Table 4-4). For the dual fluids test, the recoveries were not consistent. During the FORP testing, the recovery rate for the dual fluids testing was 0.025 gpm. Previously, dual fluids testing by Raviv (1995) indicated that the rate was between 0.0 gpm and 0.1 gpm, although the higher rates was observed only over a short duration. The free oil recovery rate for the FORP vacuum enhanced testing was only 0.009 gpm. During the FORP dual fluids pump test, the radius of groundwater influence was difficult to determine because of the tidal fluctuations.
- At well EB65, the maximum, sustained free oil recovery rate was 0.25 gpm, which was achieved during the vacuum enhanced testing. The recovery rate for the dual fluids testing at this well was significantly less, between 0.008 gpm (Table 4-4). The radius of groundwater influence was less than 5 feet for this test; the groundwater pumping rate was 0.3 gpm.

4.8 Description of Existing Free Oil Recovery System

- There is an existing oil/groundwater recovery system at the east end of Plume 1, which consists of horizontal collection drains connected to a pumping well (Sheri 3) and an individual pumping well (EBR11). The Sheri 3 system consists of series of perforated PVC horizontal drains connected to a well (Sheri 3) from which the oil/groundwater is pumped. One drain extends 180 feet south and lies 7 feet below the ground surface. A second drain extends 360 feet west and lies 5 feet to 10 feet below the ground surface. Four shorter drains are located immediately north of Sheri 3. Fluids are pumped from Sheri 3 by a float switch activated pump, and fluids are discharged to the East Side Treatment Plant or Tank 8553. In July, 1995, the total flow rate from Sheri 3 was 40 gpm. According to Raviv (1995), the existing drains were pressure jetted in 1995 to remove accumulated material, because they were plugged. In the second quarter of 1997, the average total fluids pumping rate was 9.2 gpm at well Sheri 3 (Raviv, 1997).
- At recovery well EBR11 (at east end of Plume 1), total fluids are pumped from the well to the East Side Treatment Plant or Tank 8553. The pump is manually controlled and operated approximately 4 hours per day, 5 days per week. The flow rate during pumping is less than 5 gpm. The volume of total fluids pumped from EBR11 is not know because there is no flow meter on the discharge line of this well (Raviv, 1997).

- Additionally, Exxon monitors free oil thickness and recovers oil (and water) with a vacuum truck from 12 on-site wells one time per week. The wells, with the amount of oil pumped in gallons per vacuum event shown parenthetically, are as follows: EB51 (0.01), EB52 (0.02), EB56 (0.32), EB58 (0.61), EB59 (0.11), EB62 (0.46), EB65 (1.01), EB66R (0.05), EB67 (0.92), EB69 (0.11), P7MW1 (3.95) , and P7MW2 (0.05). These wells were vacuumed two times a week, but this frequency was reduced to once per week because of slow oil recovery.

4.9 Conceptual Strategies for Free Oil Recovery Design

- The pumping test results performed during the FORP and by Raviv (1995) indicate that the sustained oil recoveries of between 0.03 gpm and 0.1 gpm were achieved in the well that was between the northern and southern gantry walls; these rates were obtained during the skimming , total dual fluids and vacuum enhanced pumping tests. South of the southern gantry wall, a sustained maximum oil recovery of 0.25 gpm was achieved using vacuum enhanced testing. While these recovery rates are variable, they indicate that rates equal to or greater than the 0.1 gpm recovery rate (which was defined as reasonable for the FORP) are achievable. Thus, a potential oil recovery methods in the eastern globular areas are skimming, total fluids, or vacuum enhanced pumping.
- On a conceptual basis, the existing free oil recovery system in the western portion of the Pier 7 Area, which consists of two pumping wells (Sheri 3 well and EBR11) and a series of drains, can be upgraded so that the system captures oil in the western globular areas of the plume. The upgrade would include installing additional perforated drains lines to collect the free oil on both sides of the southern gantry wall in the central and eastern portions of the site. Because of the tidal fluctuations in the area of Pier 7, multi-level collection pipes may be used. The discharge from this system would be piped to the nearby East Side Treatment Plant or Tank .
- The following additional information should be considered for the design of a free oil recovery system: 1) The two Gantry/bulkhead walls run the length of the pier, and extend to a depth equal to mean-sea-level; 2) The construction materials (pilings, crib-work, fill material, etc.) are largely unknown along Pier 7; 3) In addition to the sewer line on-site, fire and water lines, an old railroad spur, and probably unknown lines, are buried between the gantry walls; 4) The access road to Pier 7 is flanked by above ground piping ; 5) The access road to the pier is often very busy; and 6) An old oil/water separator was known to be buried between the existing separator and the pipe rack south of the road.

Table 4-2

Free Oil Analysis Information for Plume I

Free Oil Recovery Project

Exxon Company, USA

Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ppm)	Total BTEX (ppm)	Viscosity (cS)	Specific Gravity
EB52	Severly degraded diesel (Raviv, 1995)	NA	NA	NA	NA	NA	NA	NA
EB58	Minimally degraded diesel (Raviv, 1995)	NA	NA	NA	NA	NA	10.5	0.890
EB59	NA	NA	NA	NA	NA	NA	NA	0.862
EB60R	Minimally degraded gasoline with trace diesel (Raviv, 1995)	NA	NA	NA	NA	NA	NA	NA
EB62	Diesel (Raviv, 1995)	NA	NA	NA	387.58	0.68	57.0	0.991
EB65	NA	NA	NA	NA	50,980	11,700	2.7	NA
EB66R	NA	NA	NA	NA	NA	NA	32.5	0.830
EB67	NA	NA	NA	NA	NA	NA	9.2	0.860
EB69	Very degraded diesel (Raviv, 1995)	NA	NA	NA	NA	NA	NA	0.990
EBR10	NA	NA	NA	NA	NA	NA	1204.7	0.960
SHERI 3	NA	NA	NA	NA	NA	NA	NA	0.936
P7MWI	NA	NA	NA	NA	2,605	464	7.1	0.900

Table 4-3

Soil Profile Data for Plume 1

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
PR7SB1-2	2.0 - 3.0	13.38	0.01	0.42
PR7SB1-4	4.0 - 5.7	8.76	1.63	0.34

Note:

(1) The depth to water in PR7SB1 was approximately 6 feet below the ground surface.

Table 4-4

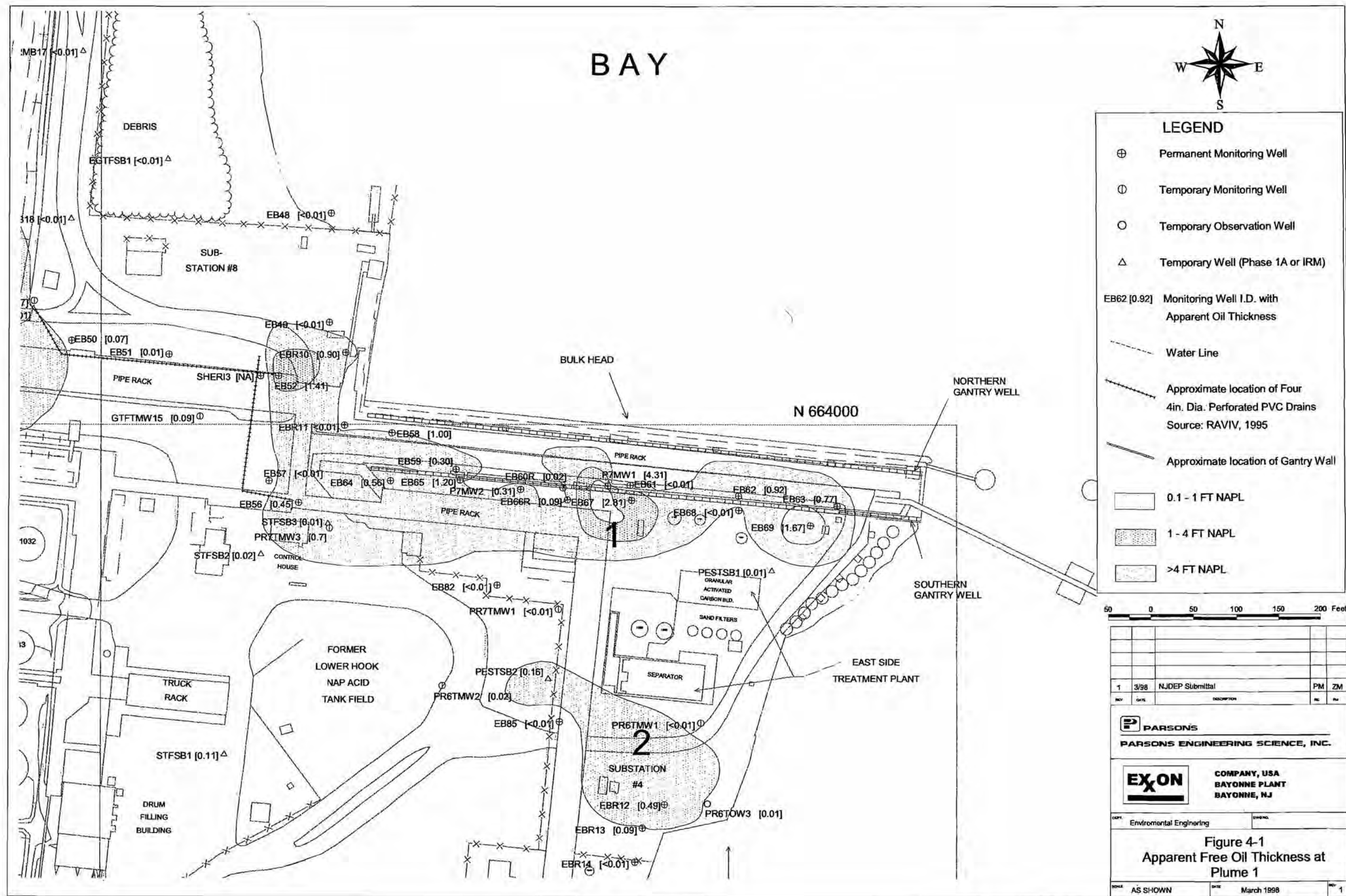
Pumping Test Results for Plume 1

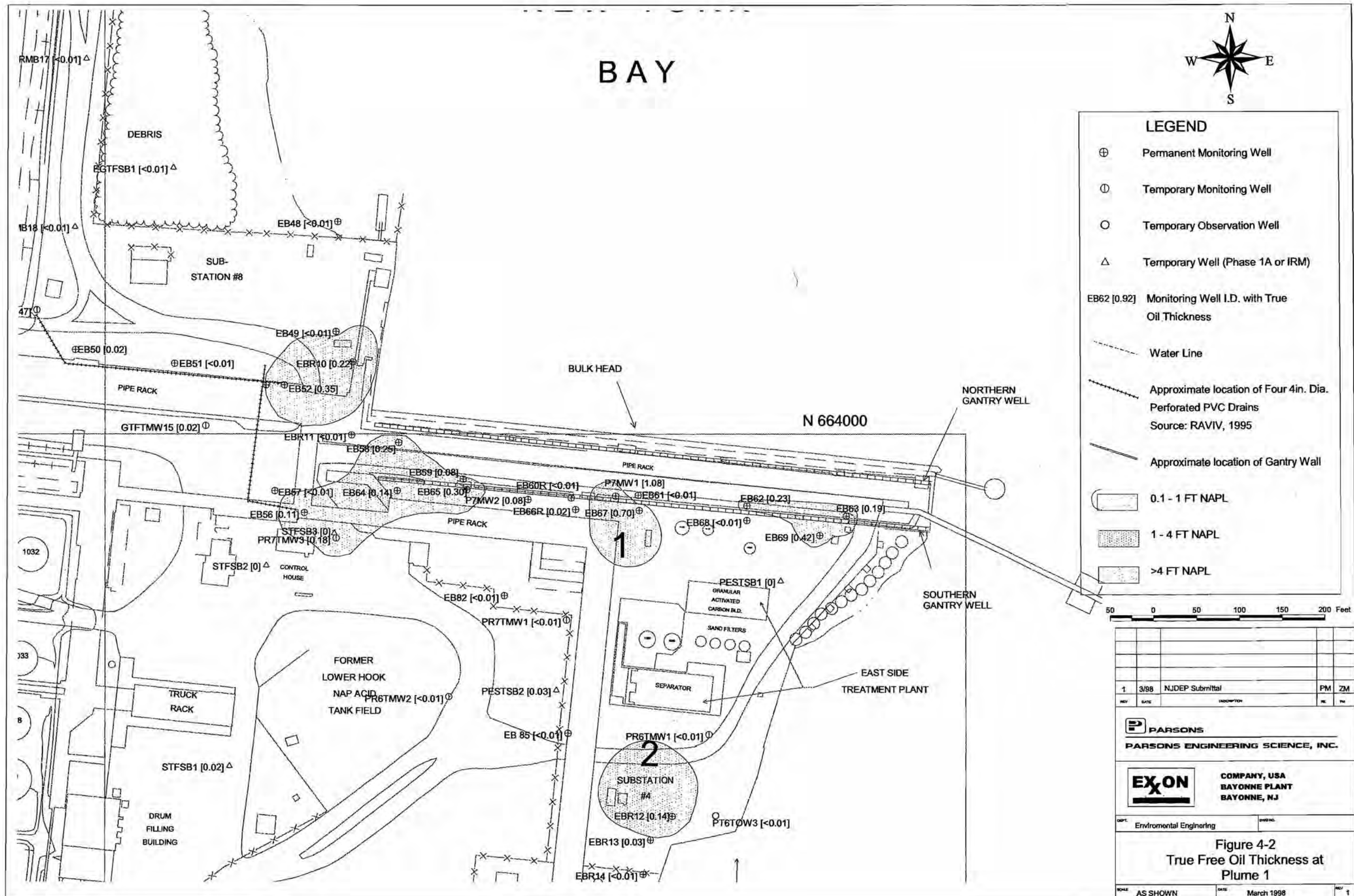
Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well ID	NAPL Skimmer Tests				Total (dual) Fluids Pumping Tests							Vacuum Enhanced Total (dual) Fluids Pumping Tests									
	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Specific Capacity (gpm/ft of drawdown in well)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)	
										Q	s	Q/s									
P7MW1	11/6/94	DRI		0.100	6/23/97	P	160	0.025	NA	1.1	3.9	0.282	6/24/97	P	144	0.009	>10	<50	3.9	3.5	50
					11/15/94	DRI	359	NA	NA	0.9	NA	0.220									
					11/18/94	DRI	510	NA	NA	0.4	NA	NA									
EB65	No Test				6/25/97	P	298	0.008	< 5	0.3	4.3	0.070	6/26/97	P	61	0.250	>10	<50	0.12	0.6	50

Notes:

1) NA = Not Available





5.0 Plumes 2 and 3 (Pier 6 Area)

5.1 Introduction

- Plumes 2 and 3 are located in the Pier 6 Area (Figure 5-1 and Figure 5-2).
- The Pier 6 Area consists of an access road and a large pipe rack that extends from Pier 6 and then bends north toward Pier 7. Oil transfer pipe lines connect Pier 6 to various tank fields. The northern portion of this area is occupied by the East Side Treatment Plant. Operations have not changed significantly since the 1940s.

5.2 Field Work

5.2.1 Free Oil Delineation Tasks

- Five temporary wells were installed at the Pier 6 Area (PR6TMW1 through PR6TMW5) (1 more than specified in the Workplan). NJDEP permits for the installation of these wells are included in Appendix D.
- As required by the Workplan, installed two permanent wells at Pier 6 (PR6MW1 and PR6MW2) to replace wells EBR16 and EB73, respectively.
- As required by the Workplan, performed 2 soil borings (PR6SB1 and PR6SB2) and collected soil samples. Collected 3 vadose zone soil samples from each boring for a total of 6 samples (2 less than specified in the Workplan due to the short length of the vadose zone at each location). Submitted these samples for analysis of FORP Workplan design parameters (% residual oil, % water, porosity, and bulk density). At each boring, one soil sample was collected within the oil zone at the water table for grain size analysis, as specified in the Workplan.
- Measured the apparent thickness of oil in all existing and proposed wells in the Pier 6 Area in accordance with the Workplan. In total, 12 measuring events were taken at Plume 2 and 13 events were taken at Plume 3.
- Performed free oil characterization on 4 samples, as indicated in the Workplan. The following analyses were performed: 1) GC fingerprinting: EBR12, EB74, PR6MW2, and PR6TMW4; 2) VOA: EBR12, EB74, PR6MW2, and PR6TMW4 ; 3) viscosity: EBR12 and PR6MW2.

5.2.2 FORP Design Support Tasks

- Performed 4 baildown tests in the Pier 6 Area (EBR12, EB72, PR6TMW4 and PR6MW2), the same number indicated in the Workplan.
- Performed free oil recovery rate testing at 2 wells (EBR12 and PR6MW2), the same number as specified in the Workplan.
- Prior to the test at EBR12 installed three observation wells at 5, 10, and 50 foot intervals from the well (PR6TOW1 through 3), as required by the Workplan. Performed total dual fluids pumping and vacuum enhanced tests at well EBR12 (1 more test than specified in the Workplan).

- Prior to the test at PR6MW2, installed three observation wells at 5, 10 and 50 foot intervals from the well (PR6TOW4 through 6), as required by the Workplan. Performed total dual fluids pumping and vacuum enhanced pumping tests at well PR6MW2 (1 more test than specified in the Workplan).

5.3 Description of Hydrogeology

The hydrogeology of the Pier 6 Area is summarized in the following bulleted items:

- The subsurface materials generally consist of fill to depths of approximately 45 feet below the ground surface according to Raviv (1995). Soil descriptions from the deepest boring performed during the FORP (well PR6MW2) indicated that the fill extended to at least 21 feet; the base of fill was not encountered in any of the FORP borings. The fill is generally composed of fine to medium sand and cinders, slag and coal material. In the northern portion of the Pier 6 Area, there was a thin (0.5-foot thick) surficial silt layer.
- In the vicinity of where the thickest apparent free oil was measured at Plume 2, the subsurface material near the water table consisted of fine to coarse sand with cinders, slag and coal fragments with trace silt.
- At Plume 2, grain size analysis of a soil sample collected near the water table (from 6.0 feet to 6.5 feet) in a boring (PR6SB1) that was performed adjacent to EBR12 indicated that the subsurface material contained approximately 4% silt and clay, 26% fine sand, and the remaining 70% was composed of coarser sand and gravel particles. This analysis is consistent with the soil description for the interval near the water table given above.
- At Plume 3, the grain size analysis from boring PR6SB2 (from 10 feet to 10.6 feet) indicated that the subsurface material contained approximately 10% silt and clay, 23% fine sand, and the remaining 67% was composed of coarser sand and gravel particles. This analysis is consistent with the soil description for the interval near the water table given above.
- An unconfined groundwater zone is present in the fill on-site, and groundwater in the Pier 6 Area is generally between 5 feet and 10 feet below the ground surface and it is affected by the tides.
- The groundwater flow direction in the Pier 6 Area is predominantly to the east based on the mid-tide groundwater contour map (**Figure 3-1**). The hydraulic gradient is 0.002.
- The unconfined groundwater zone is influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides. The tidal influence affected 7 wells that were parallel to the shoreline at Pier 6. The maximum tidal variation in these wells was 1.60 feet. The tidal influence extended approximately 5 feet inland; at 100 feet inland (at well EB72) the tidal fluctuation was small (0.07 feet).

5.4 Free Oil Delineation Results

5.4.1 Plume 2

Apparent Free Oil Thickness

- Plume 2 is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 5-1**). A total of 11 wells were used for the delineation. The horizontal extent of Plume 2 has been confirmed, and no further delineation is required.
- Plume 2 is an elongate plume that occurs approximately 100 feet north of Pier 6. The maximum apparent free oil thickness (0.49 feet) was measured in EBR12 in the eastern portion of the plume (**Figure 5-1**).

True Free Oil Thickness

- The true free oil thicknesses plume at Plume 2 is circular (**Figure 5-2**). The maximum true free oil thickness was 0.14 feet at EBR12.
- An exaggeration ratio of 3.5 was used for Plume 2.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 2 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 1 baildown test completed at Plume 2 (**Table 5-1**). The subsurface material near the water table consisted of fine to coarse sand with cinders, slag and coal fragments with trace silt. These descriptions correspond to a soil type of between sand and sandy loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for soil of these types has a range of between approximately 2 and 3.5. In addition, the exaggeration ratio from 1 baildown test indicated an exaggeration ratio of 9.41. The ratio from the baildown test is greater than the range reported in the EPA guidance for the soil types present. A combination of slow free oil recovery and a fluctuating water table due to the tides made it difficult to obtain good (i.e., typical) data for the tests. Thus, the interpretation of the exaggeration ratios were difficult and we did not rely heavily on the ratios derived for the baildown testing at Pier 6. Therefore, given the available data, an exaggeration ratio of 3.5 was used for Plume 2. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix D**.

5.4.2 Plume 3

Apparent Free Oil Thickness

- Plume 3 is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 5-1**). A total of 13 wells were used for the delineation. The horizontal extent of the Plume 3 has been confirmed, and no further delineation is required.
- Plume 3 is an irregularly shaped plume that exists immediately south of Pier 6. The maximum apparent free oil thickness was 2.11 feet at PR6TMW4 (**Figure 5-1**).

True Free Oil Thickness

- Plume 3, based on its true free oil thickness, is elongate (**Figure 5-2**). The maximum true free oil thickness was 0.60 feet at PR6TMW4.
- An exaggeration ratio of 3.5 was used for Plume 3.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 3 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 3 baildown tests completed at the Pier 6 Area (**Table 5-1**). The subsurface material near the water table consisted of fine to coarse sand with cinders, slag and coal fragments with trace silt. These descriptions correspond to a soil type of between sand and sandy loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for soil of these types has a range of between approximately 2 and 3.5. In addition, the exaggeration ratio from 3 baildown tests ranged between 5.80 and 7.81, and the average exaggeration ratio was 6.76. The ratios from the baildown tests are greater than the range reported in the EPA guidance for the soil types present. A combination of slow free oil recovery and a fluctuating water table due to the tides made it difficult to obtain good (i.e., typical) data for the tests. Thus, the interpretation of the exaggeration ratios were difficult and, therefore, a conservative exaggeration ratio based primarily on soil types was applied. Therefore, given the available data, an exaggeration ratio of 3.5 was used for Plume 3. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix E**.

5.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plumes 2 and 3 are included on **Table 5-2**. This table includes free oil characterizations from previous studies performed at the Pier 7 area.

- The oil samples from Plume 2 and 3 are generally characterized by the same material.
- Four samples from the Pier 6 Area (EBR12, EB74, EBR18, and PR6MW2) are all characterized as a severely weathered automotive gasoline or moderately weathered kerosene, Jet A, JP-1 or JP-5. This is consistent with two samples from EBR12 and EBR18 that were previously fingerprinted by Raviv (1995) (**Table 5-2**).
- A sample collected from the southern portion of Plume 3 (PR6TMW4) was clearly distinct from the other samples in the Pier 6 Area. This sample was shown to contain a middle to heavy distillate fuel (fuel oil #6) and/or crude oil. This marked difference argues against this sample of oil being related to the gasoline to kerosene range oil in other portions of Plume 3 and in Plume 2.
- The specific gravity of the free oil collected from six wells (all from Raviv, 1995) ranged between 0.851 and 0.940 (**Table 5-2**).
- Analyses were performed on soil samples collected along a vertical profile in soil borings PR6SB1 and PR6SB2, which were drilled approximately 5 feet from wells EBR12 and EBR18, respectively. At PR6SB1, the results showed that the percent of oil and grease in the vadose zone increases with depth (**Table 5-3**). The oil and grease data from PR6SB2 show no trend. The laboratory data for percent oil is contained in **Appendices D and E**.

5.6 Potential Sources of Free Oil

Areas of potential sources of free oil at the Pier 6 Area include oil/water separators, drum storage areas, sumps, the East Side Treatment Plant, loading and unloading areas, and storm sewers.

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the Pier 6 Area:

- There are no documented spills of oil within the footprints of Plumes 2 and 3 at the Pier 6 Area.

- Two former process areas may have contributed oil to Plumes 2 and 3. A cooperage and light oil filling building existed from 1918 to 1963 in the northwestern (upgradient) portion of Plume 3; this area was also a former drum storage area. A barrel staging area existed from 1921 to 1963 in a location that was immediately south of Plume 2. Thus, based on these geographic associations alone, these process areas, with their associated pipelines, may be potential sources of oil for these plumes.
- No sewer lines pass near Plume 3, and thus releases from sewers are not a potential source for Plume 3.

5.7 Free Oil Pump Testing Results

As part of the FORP, free oil pump tests were performed at wells EBR12 and PR6MW2, which are located in Plumes 2 and 3, respectively (Table 5-4). EBR12 was within the area of tidal influence based on the two rounds of low and high tide water level measurements; well PR6MW2 was not. Also, information on skimming and dual fluids free oil recovery rates for wells EBR12, EBR18, and EB73 (a former well) was also obtained from tests previously performed by Raviv (1995). The detailed FORP results are contained in Appendix D and E.

- At well EBR12 (Plume 2), the best oil recovery rate (0.069 gpm) was obtained using skimming, however, it is questionable if this rate was sustainable (Raviv, 1995). The dual fluids pumping test results by Raviv (1995) showed that the free oil recovery was better using a low groundwater pumping rate (about 5 gpm), compared to the oil recovery rates (i.e., sheens) obtained using groundwater pumping rates of 10 gpm and higher. The higher groundwater pumping rates result in more drawdown and have the potential to "strand" the oil in the formation and, therefore, not enhance the flow of oil into the well. As noted for the skimming test above, the dual fluids testing results showed the best oil recovery rate (i.e., sheen) was not sustainable. During the FORP dual fluids pump test, the radius of groundwater influence was difficult to determine because of the tidal fluctuations, however, when tidal fluctuations are taken into account, the radius is greater than 50 feet using a groundwater pumping rate of 30 gpm. At a pumping rate of 10 gpm the radius of groundwater influence was uncertain.
- At well PR6MW2 (Plume 3), the sustained free oil recovery rate was 0.032 gpm for the dual fluids pumping test and it was 0.024 gpm for the vacuum enhanced testing (Table 5-4). During the dual fluids testing the highest oil recovery rate was achieved using a groundwater pumping rate of 10 gpm; the radius of groundwater influence for these pumping rates was less than 40 feet.
- At well EBR18 (Plume 3), no sustained oil recovery could be achieved (Raviv, 1995).
- At former well EB73 (in the western part of Plume 3), the oil recovery rate was 0.004 gpm using oil skimming (Raviv, 1995).

5.8 Description of Existing Free Oil Recovery System

- An existing, but currently non-functioning, free oil recovery system is located in the Pier 6 Area. It is believed to have been installed in the 1970s (Raviv, 1995). The system consists of eight recovery wells (EBR12 through EBR15, EBR18, EBR19, EBR21 and EBR23) and a network of discharge pipes and pumps. In 1992, the discharge lines were modified and connected by a 4-inch PVC pipe to the East Side Treatment Plant. Electricity and pumps area located at many of the wells.

5.9 Conceptual Strategies for Free Oil Recovery

- At Plume 2, sustained oil recovery is not practicable at this time, based on the 0.1 gpm oil recovery rate criterion. The pumping test results performed during the FORP and by Raviv (1995) indicate that the best oil recovery was obtained using skimming (0.069 gpm) and, next was dual fluids pumping (0.025 gpm) with a low groundwater pumping rate (about 5 gpm). The recovery for the skimming test was slightly lower than the 0.1 gpm free oil recovery rate established as the benchmark in the FORP Workplan (Parsons, 1997). Therefore, even though yields < 0.1 gpm are anticipated, conceptual remedial methods evaluated for free oil recovery will include sustained free oil skimming.
- At Plume 3, sustained oil recovery is not practicable at this time, based on the 0.1 gpm oil recovery rate criterion. The free oil recovery rates were higher (in some areas of the Plume 3) compared to those obtained in Plume 2. The highest sustained free oil recovery rate ranged between 0.032 gpm and 0.024 gpm, which was achieved during the dual fluids pumping test and the vacuum enhanced testing, respectively. During the dual fluids testing, the highest oil recovery rate was achieved using groundwater pumping rates of 10 gpm; the radius of groundwater influence for these pumping rates was less than 40 feet. Skimming and dual fluids pumping tests in the northern portion of the plume did not yield any sustained oil recovery. Therefore, even though yields < 0.1 gpm are anticipated, conceptual remedial methods to be evaluated for free oil recovery include free oil pumping using total dual fluids pumping and vacuum enhanced dual fluids pumping from vertical recovery wells.
- Another conceptual design at Plumes 2 and 3 would be to use a recovery trench. The trench design would have to consider tidal fluctuations. This alternative would potentially recover oil without the need for the relatively high groundwater pumping rates that would likely be used for recovery from individual wells (as noted above).
- At Plumes 2 and 3 the following additional information should be considered for the design of a free oil recovery system: 1) Access to the Pier 6 Area, and construction activity in the area, may be difficult because of ships that often unload products; 2) There are probable buried power lines and buried sewer lines in the area; 3) There may be undermining and voids present at locations behind parts of the bulkhead; 4) Pipelines related to the old barrel filling area have been abandoned in the area; these lines may extend to the bulkhead.

Table 5-1

Baildown Testing Results for Plumes 2 and 3

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 2 - Pier 6						
6/16/97	EBR12	P	0.49	0.05	9.41	Tidal
					9.41	Exaggeration Ratio

3.5	Applied Exaggeration Ratio
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Plume 3 - Pier 6						
6/23/97	PR6TMW4	P	2.11	0.27	7.81	Tidal
7/18/97	PR6MW2	P	0.80	0.12	6.67	
6/16/97	EB72	P	0.73	0.13	5.80	Tidal
					6.76	Average Exaggeration Ratio

3.5	Applied Exaggeration Ratio
------------	-----------------------------------

Table 5-2

Free oil Analysis Information for Plumes 2 and 3

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
EBR12 (Plume 2)	Severely weathered, automotive gasoline or moderately weathered kerosene, Jet A, JP-1, JP-5 (consistent with very degraded gasoline characterization of Raviv, 1995)	16	76	8	2,996,000	124,000	10.3	0.865
EB72 (Plume 3)	NA	NA	NA	NA	NA	NA	NA	0.851
EB73 (Plume 3)	NA	NA	NA	NA	NA	NA	NA	0.940
EB74 (Plume 3)	Severely weathered, automotive gasoline or moderately weathered kerosene, Jet A, JP-1, JP-5	15	78	8	30,762,000	102,000	NA	NA
EBR18 (Plume 3)	Very degraded gasoline (Raviv, 1995)	NA	NA	NA	NA	NA	3.8/247.5	0.851/0.852
PR6MW2 (Plume 3)	Severely weathered, automotive gasoline or moderately weathered kerosene, Jet A, JP-1, JP-5	17	68	15	18,411,500	45,500	3.9	NA
PR6TMW4 (Plume 3)	Moderately weathered middle to heavy distillate (e.g., fuel oil #6) or crude oil	3	64	33	10,121,000	155,000	NA	NA

Table 5-3

Soil Profile Data for Plumes 2 and 3

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
PR6SB1-2	2.0 - 3.1	0.16	17.93	0.46
PR6SB1-4	4.0 - 5.0	0.26	12.16	0.51
PR6SB1-6	6.0 - 6.5	4.30	22.92	0.46
PR6SB2-2	2.0 - 3.5	<0.01%	9.92	0.32
PR6SB2-4	4.0 - 5.2	0.02	5.04	0.37
PR6SB2-6	6.0 - 7.3	0.01	NA	N/A
PR6SB2-10	10.0 - 10.6	NA	11.36	0.24

Notes:

(1) NA = Not Available

(2) The depth to water in PR6SB1 (plume 2) was approximately 8 feet below the ground surface.

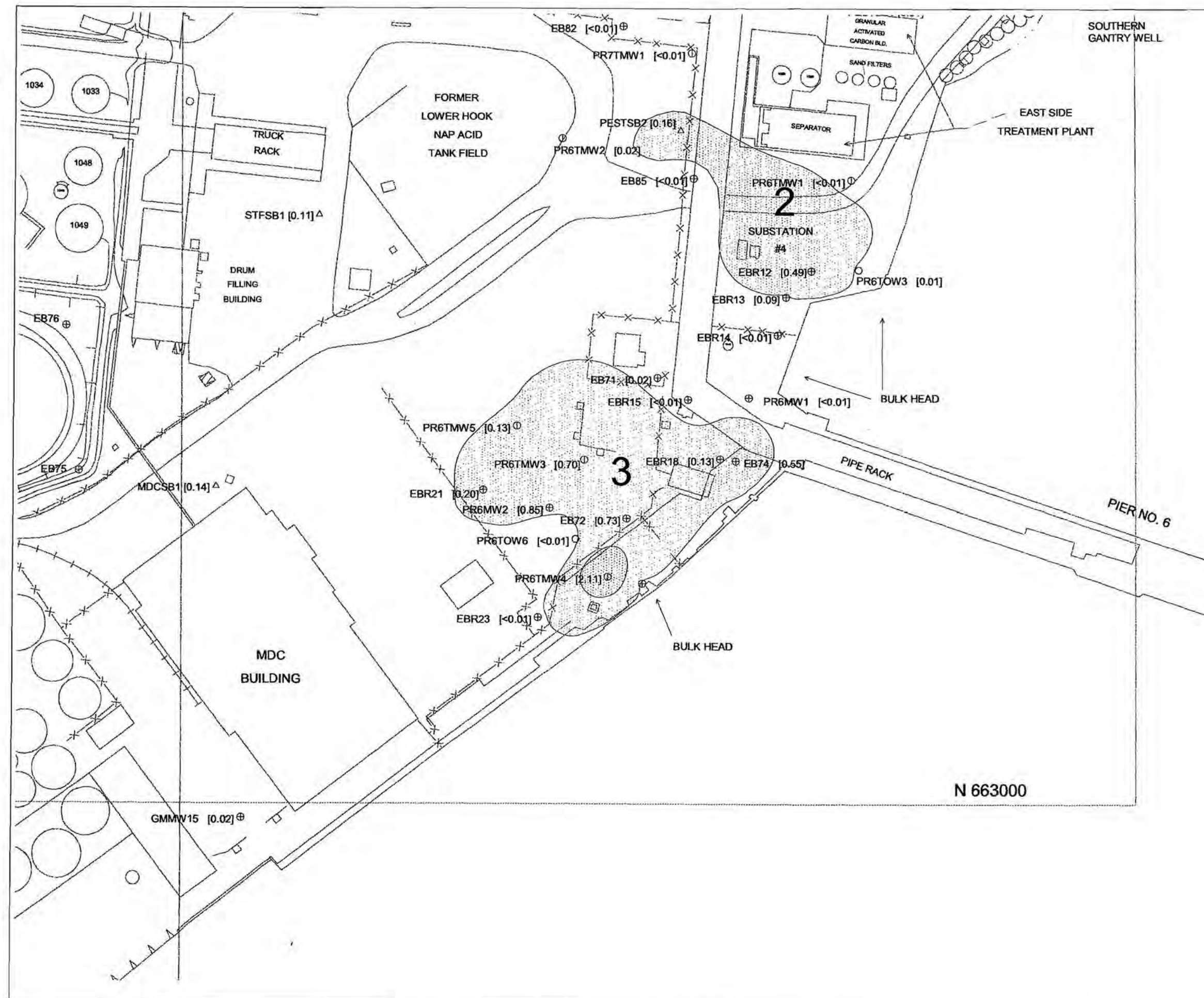
(3) The depth to water in PR6SB2 (plume 3) was approximately 7.5 feet below the ground surface.

Table 5-4

Pump Testing Results for Plumes 2 and 3

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

NAPL Skimmer Tests					Total (dual) Fluids Pumping Tests								Vacuum Enhanced Total (dual) Fluids Pumping Tests								
Well ID	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)	Ground Water Pumping Rate (gpm) Q	Sustained Ground Water Drawdown (feet) s	Specific Capacity (gpm/ft of drawdown in well) Q/s	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (In of H ₂ O)	
EBR12 (Plume 2)	5/20/95	DRI	272	0.069	6/30/97	P	128	Sheen	NA	10.0	0.6	17.857	7/2/97	P	338	Sheen	>10	<50	48	6.4	19
					7/1/97	P	89	Sheen	>50	30.0	3.8	8.333									
					7/1/97	P	186	Sheen	>50	48.0	5.8	7.931									
					8/21/95	DRI	1471	0.025	NA	4.5	NA	NA									
PR5MW-2 (Plume 3)	No Test				7/3/97	P	185	0.032	NA	<40	10.0	0.4	25.641	7/8/97	P	234	0.024	>40	30	-0.2	28
					7/7/97	P	269	0.016	>5	<40	30.0	0.7	46.154								
					7/7/97	P	132	0.022	>5	<40	49.0	1.6	28.000								
EBR18 (Plume 3)	5/23/95	DRI	4384	0.000	6/26/95	DRI	1349	0.000	NA	3.2	NA	NA	No Test								
EB73 (Plume 3)	6/28/95	DRI	NA	0.004	No Test								No Test								



LEGEND

- ⊕ Permanent Monitoring Well
- ⊙ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)

EB62 [0.92] Monitoring Well I.D. with Apparent Oil Thickness

Water Line

0.1 - 1 FT NAPL

1 - 4 FT NAPL

>4 FT NAPL

50 0 50 100 150 200 Feet

1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK



PARSONS ENGINEERING SCIENCE, INC.

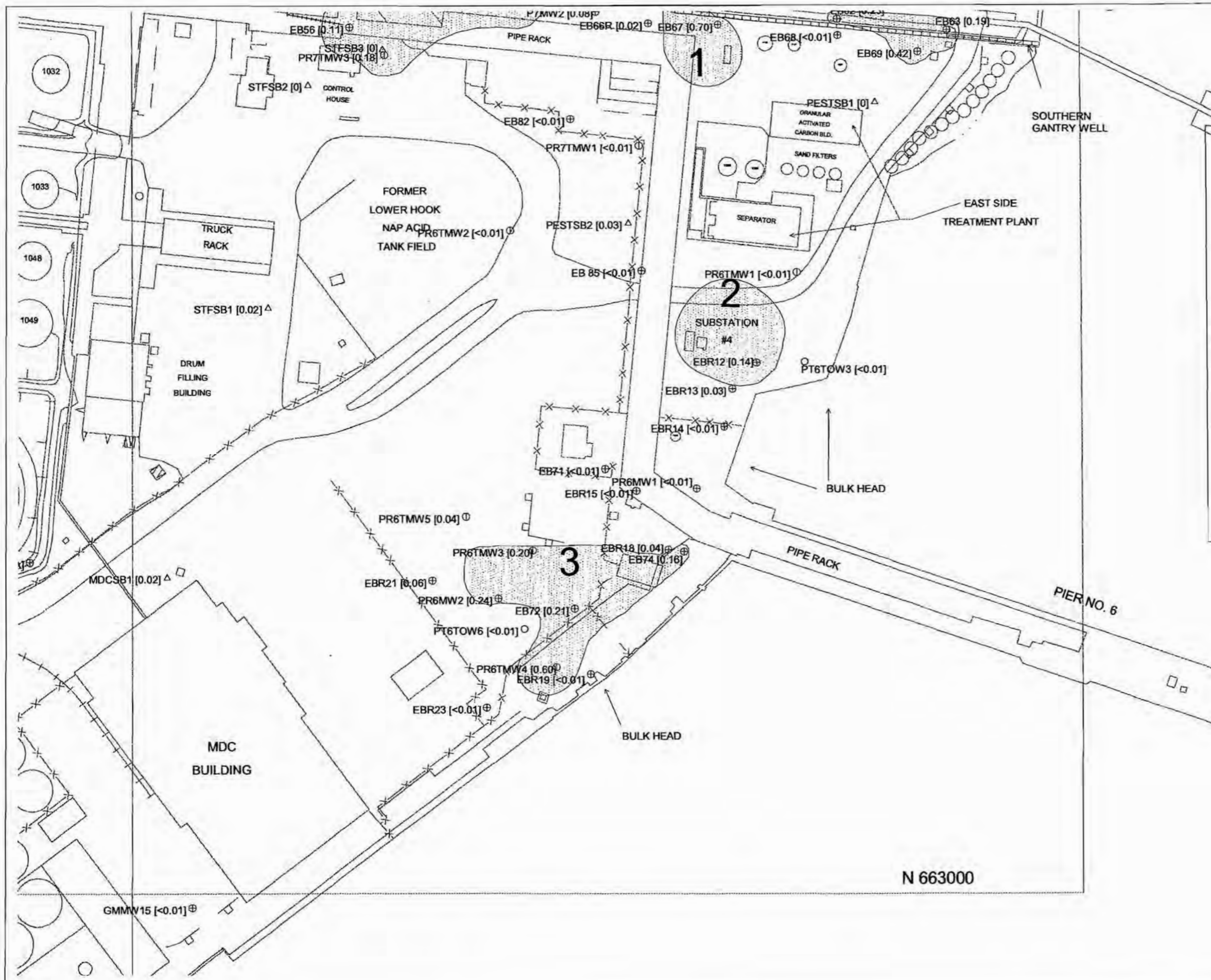


COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

DISC: Environmental Engineering ENGINE:

Figure 5-1
Apparent Free Oil Thickness at
Plumes 2 and 3

SCALE: AS SHOWN DATE: March 1998 REV: 1



LEGEND

- ⊕ Permanent Monitoring Well
- Ⓢ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)

EB62 [0.92] Monitoring Well I.D. with True Oil Thickness

--- Water Line

- [Pattern] 0.1 - 1 FT NAPL
- [Pattern] 1 - 4 FT NAPL
- [Pattern] >4 FT NAPL



1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

EXXON
COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

DEPT. Environmental Engineering

Figure 5-2
True Free Oil Thickness at
Plumes 2 and 3

6.0 Plumes 5 and 6 (General Tank Field)

6.1 Introduction

- Plumes 5 and 6 are located in the General Tank Field (**Figure 6-1** and **Figure 6-2**).
- The General Tank Field consists of 14 tanks in two secondary containment areas. When Exxon operated the tanks, they contained #6 oil, jet, #2 heating oil and storm water. In 1940, in addition to the tanks, the only buildings in this area included a utility store room and a general pump house. Also, from some time in the 1940s to 1968, the northern portion of the General Tank Field was part of the Bayonne Municipal Dump.

6.2 Field Work

6.2.1 Free Oil Delineation Tasks

- A total of 16 temporary wells were installed at Plumes 5 and 6 (2 more than specified in the Workplan) (GTFTMW1 through GTFTMW16). NJDEP permits for the installation of these wells are included in Appendix F.
- A total of 4 permanent wells (GTFTM1, GTFMW2, GTFMW3, and GTFMW4) were installed in the General Tank Field, in accordance with the Workplan. Because of the limited size of Plume 5, only 1 of these wells was installed at Plume 5 (for long term monitoring purposes).
- As required by the Workplan, 6 soil samples were collected during the installation of temporary wells GTFTMW1 and GTFTMW4 (2 less than specified in the Workplan due to the relatively shallow water table in one of the wells). The soil samples were analyzed for FORP Workplan design parameters (% residual oil, % water, porosity, and bulk density). Also, 1 of these soil samples (1 less than specified in the Workplan) was collected within the oil zone on the water table for grain size analysis.
- Measured the apparent thickness of oil in all existing and proposed wells in the General Tank Field in accordance with the Workplan. In total, 13 measuring events were taken at Plume 5 wells and 23 were taken at Plume 6 wells.
- Performed free oil characterization on 5 samples, as required by the Workplan. The following analyses were performed: 1) GC fingerprinting: GTFTMW3, GTFTMW8, GTFTMW9, GTFTMW15 and MW7; 2) VOA: GTFTMW3, GTFTMW8, GTFTMW9, and MW7; and 3) Viscosity: GTFTMW3, GTFTMW8, GTFTMW9, and MW7. No samples were collected at Plume 5 because of the limited nature of the plume.

6.2.2 FORP Design Support Tasks

- Performed baildown tests in a total of 5 wells at Plume 6 (one more than specified in the Workplan). The tests were performed on wells GTFTMW3, GTFTMW4, GTFTMW8, GTFTMW9, GTFMW1. No baildown tests were performed at Plume 5 because the apparent thickness of oil in the wells was thin (approximately 0.2 feet).

- Performed free oil recovery rate testing at 2 wells (GTFMW1 and GTFMW4) (2 less than specified in the Workplan; none were performed at Plume 5 because the apparent thickness of oil in the wells was approximately 0.2 feet). A third test was attempted at GTFMW1, however, after installation of the permanent well, no free oil was measured, therefore, no test was performed at this location.
- Prior to the test at GTFMW1, installed three observation wells at 5, 10, and 50 foot intervals from the well (GTFTOW1 through 3), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping, and vacuum enhanced testing at this well, as required by the Workplan.
- Prior to the test at GTFMW4, installed three observation wells at 5, 10, and 50 foot intervals from the well (GTFTOW4 through 6). Performed vacuum enhanced testing at this well to determine if this method could induce oil to flow to this well, which according to a Geraghty & Miller (1995) map had 4.67 feet of oil, however, none was measured during the FORP investigation. The free oil skimmer testing and total dual fluids pumping were not performed at this well because the vacuum enhanced testing was deemed to be the most effective method.

6.3 Description of Hydrogeology

- The subsurface materials at the General Tank Field are composed of fill. The fill consists of silt and fine to coarse sand and gravel, containing of cinders, coal, wood and glass, to depths of 10 to 16 feet. Locally the fill material is very loose. According to Geraghty & Miller (1995), peat and organic soils (which are at least 2 feet thick) are present below the fill material at depths of between 9 feet and 14 feet below the ground surface. This general stratigraphy (i.e., fill overlying a peat layer) found during the FORP is similar to the stratigraphy presented in Geraghty & Miller (1995).
- In the vicinity where the thickest apparent free oil was measured at Plume 6, the subsurface material near the water table consisted of fine to medium sand, little silt, with crushed coal and slag.
- Grain size analysis was performed on one sample collected near the water table in the Exxon General Tank Field. The sample, which was collected from 6.0 feet to 7.4 feet at GTFTMW4, contained approximately 19% fine sand, 9% silt/clay, and the remaining 72% was composed of coarser sand and gravel. The result of this analysis is consistent with the soil descriptions in borings near the water table given above.
- An unconfined groundwater zone is present in the fill at General Tank Field, and groundwater is approximately 5 feet to 6 feet below the ground surface.
- The groundwater flow direction is to the northeast toward the Upper New York Bay at the General Tank Field (Figure 3-1). A small elongate groundwater mound exists immediately south of the General Tank Field (formed by well GMMW14, MW7, GTFMW4, MW10 and MW11), which appears to hydraulically separate the General Tank Field from the Low Sulfur Tank Field to the south. The hydraulic gradient over most of the General Tank Field is 0.001. This elongate mound runs parallel to a water main located in the access road to Pier 7.
- The unconfined groundwater zone is not influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides.

6.4 Free Oil Delineation Results

6.4.1 Apparent Free Oil Thickness

- Plumes 5 and 6 were defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (**Figure 6-1**), and it is clear from the map that Plume 6 is the more significant of the two plumes. A total of 49 wells were used for the delineation. Thus, the horizontal extent of the plume has been confirmed, and no further delineation is required.
- Plume 5 is comprised of two small areas of free oil, which indicate that the plume is characterized by a thin, discontinuous zone of oil (**Figure 6-1**). The oil was measured in wells GTFSB2 (a previously installed temporary well) and GMMW10 (an existing permanent well). The maximum apparent free oil thickness was approximately 0.24 feet. The horizontal extent of Plume 5, as depicted in this FORP, is significantly smaller compared to how it was depicted in the Geraghty & Miller (1995) report.
- Plume 6 is oval-shaped, and based on data from a previous temporary well (GTFSB8), there is a small, separate area of oil west of the main plume (**Figure 6-1**). At Plume 6, the maximum apparent free oil thickness was 7.67 feet.

6.4.2 True Free Oil Thickness

- There are no areas where the true free oil thicknesses of Plume 5 is greater than 0.1 feet.
- Plume 6 is oval-shaped (**Figure 6-2**). The maximum true free oil thickness at Plume 6 was 1.28 feet at well GTFMW8.
- An exaggeration ratio of 6 was used for Plumes 5 and 6.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plumes 5 and 6 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 4 baildown tests completed at General Tank Field (**Table 6-1**). The subsurface material near the water table consisted of fine to medium sand, little silt, with crushed coal and slag. These descriptions correspond to a soil type between a sandy loam and loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for soils of these types have a range of between approximately 2 and 6. In addition, the exaggeration ratios from 4 baildown tests ranged from 2.72 to 12.78, and the average exaggeration ratio was calculated to be 7.68. The ratios from the baildown tests are greater than the range reported in the EPA guidance for the soil types present. Therefore, given the available data, an exaggeration ratio of 6 was used for Plumes 5 and 6. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix F**.

6.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plumes 5 and 6 are included on **Table 6-2**. Results from the characterization are presented below.

- The three wells from within Plume 6 (GTFTMW3, GTFTMW8, and GTFTMW9) were similar in that they were predominantly comprised of a moderately degraded diesel fuel or fuel oil #2 (Table 6-2). The presence of a gasoline range product(s) that was particularly enriched in ethylbenzene and xylenes could indicate that there was a contribution from a light, aromatic solvent to the southwest portion of Plume 6. The viscosities of these three samples are all different; they range from 4.7 cs to 24.0 cs. Generally, the percentages of GRO, DRO, and RRO in the three samples is the same, however, the sample from GTFTMW8 has a higher GRO percentage, which reflects the gasoline range component in this sample. The VOC and BTEX levels in GTFTMW8 were also elevated which is consistent with the presence of a gasoline range component.
- The sample from MW7, which is located in Plume 4, contained oil that was completely unrelated to those observed in the Plume 6 wells. The MW7 material was likely to be an unweathered petroleum naphtha, or perhaps JP-4, of which there was no evidence of in any of the Plume 6 wells
- A sample from GMMW10 was analyzed previously by Dan Raviv (1995). This well is located in the southernmost component of Plume 5 within the General Tank Field. This oil was a mixture of moderately degraded diesel fuel/fuel oil #2 and some unique, heavier, waxy materials, and it is clearly distinct from the Plume 6 oils studied for the FORP. This argues against any continuity or common source for the GMMW10 oil and the Plume 6 oils.
- The specific gravity of oil from wells in the central and western portions of Plume 6 was greater than the specific gravity of oil from the western end of Plume 4 (MW7).
- Analyses of soil samples collected along a vertical profile in soil borings next to GTFTMW1 (at Plume 5) and GTFTWM4 (at Plume 6) showed that the percentage of oil in the samples generally increased with depth (Table 6-3).

6.6 Potential Sources of Free Oil

Areas of potential sources of free oil at the General Tank Field include ASTs, oil/water separators, a portion of the former Bayonne Municipal Dump, a former lead-contaminated separator sludge dump, and sewers systems (Geraghty & Miller, 1994). Also, two spills in excess of 100 gallons, one of oil and the other of oily sludge, have been documented at the General Tank Field.

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the General Tank Field:

- Two spills, one of oil (300 gallons) and the other of oily sludge (1,000 gallons), occurred in 1990 at Tanks 1058 and 1059, respectively, however, both spill locations are north (downgradient) of Plume 6, and are unlikely sources of Plume 6.
- A former General Pump House is the only process-related feature that is associated with Plume 6; it occurred at its western (upgradient) end, and only by this physical association can it be considered a potential source.

- Main Sewer Trunk Line #5 and three associated lateral lines (5A, 5B, and 5C) pass through the General Tank Field. Two areas of major findings from the sewer evaluation have been reported to NJDEP (MH5A-3 to MH5-3 and MH5-3 to MH5-5), the first of which coincides with Plume 5. The pipes are partially submerged, have experienced cracking and apparent ovalization due to external loads, and a stagnation zone exists such that trapped oil could have exfiltrated from the sewer. This is consistent with the thin (approximately 0.2 feet apparent thickness) and localized nature of plume 5.

6.7 Free Oil Pump Testing Results

Free oil pump tests were performed at wells GTFMW1 and GTFMW4 at Plume 6 in the General Tank Field, which is a non-tidal area. The results of the tests are summarized below. The detailed results are contained in **Appendix F**.

- At well GTFMW1, which had a design apparent thickness of approximately 1.6 feet during the FORP, no sustained oil recovery was achieved for the skimmer test, and for the total dual fluids pumping test the recovery rate was 0.01 gpm. The sustained recovery rate for the vacuum enhanced pumping test was 0.03 gpm (**Table 6-4**). During the dual fluids test, the radius of groundwater influence was greater than 50 feet, using a groundwater pumping rate of between 7.0 gpm and 8.4 gpm.
- At well GTFMW4, no oil was initially measured in this well 16 days after its installation, even though 7.67 feet of oil had previously been measured in a temporary well (GTFMW8) at this location during the FORP. At the time of the test, the screened interval of the permanent wells was checked to make sure that it intercepted the water table, and it did. Therefore, a vacuum enhanced test was performed to draw oil into the well for the test. No oil was recovered during this test, however, in subsequent gauging events, oil was found to have entered the well to a maximum apparent thickness of 1.16 feet.
- At well GTFMW2, no oil was present in the well at the time of the test, so no test was performed here. At the time of the test, the screened interval of the permanent well was checked to make sure that it intercepted the water table, and it did.

6.8 Description of Existing Free Oil Recovery System

There is no existing free oil recovery system at Plumes 5 and 6. The closest recovery system is approximately 300 feet east of the eastern edge of Plume 6, which collects free oil in the western portion of Plume 1 via a small network of perforated horizontal drains and an associated recovery well (Sheri 3).

6.9 Conceptual Strategies for Free Oil Recovery Design

- There are no existing free oil recovery systems at Plume 5 or Plume 6.
- At Plume 5, sustained free oil recovery is not practicable at this time. There is no discernible/recoverable free oil present (i.e., the true thickness of oil is less than 0.1 feet). Therefore, conceptual remedial methods to be evaluated at this plume include natural or *in-situ* biodegradation with continued monitoring.

- At Plume 6, sustained free oil recovery is not practicable at this time, based on the 0.1 gpm free oil recovery rate criterion. The pump test results indicate that the highest sustained free oil recovery rates were between 0.03 and 0.065 gpm, using vacuum enhanced pumping; however, these rates are below the 0.1 gpm recovery rate that was deemed reasonable in the FORP Workplan. The maximum recovery rates for the total dual fluids pumping were significantly lower (0.001 gpm and 0.03 gpm). At another test well (GMMW4) that had no oil at the time of the test, vacuum enhanced pumping was used in an attempt to induce oil to flow to the well. While no oil was recovered during the test, oil was measured in this well in subsequent measuring events.
- At Plume 6, a conceptual free oil recovery option would be to extend the western extension of the existing Sheri3 perforated drain recovery system so that it intercepts Plume 6. The drain system would have to be extended approximately 500 feet to the west. According to Raviv (1995), the existing drains were recently (in 1995) pressure jetted to remove accumulated material, because they were plugged.
- Another conceptual method for oil recovery at Plume 6 would be to use active total fluids or vacuum enhanced pumping in a series of vertical wells, although the recovery rates for this method would be expected to be between 0.03 gpm and 0.06 gpm, which is below the 0.1 gpm recovery criteria.
- At Plumes 5 and 6, the following information should be considered for the design of a free oil recovery system: 1) Infrastructure associated with pipe racks, fire lines (water), and buried electrical, and the access road must be considered for any designs along the south edge of Plume 6; 2) Within Plume 6, there are old tank bottoms, foundations from concrete berms, and construction debris; 3) The berms within the General Tank Field have been identified as areas with medium to high density chromium contamination.

Table 6-1

Baildown Testing Results for Plumes 5 and 6⁽¹⁾

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
6/18/97	GTFTMW3	P	1.49	0.27	5.52	
6/27/97	GTFTMW4	P	2.23	0.23	9.70	
6/19/97	GTFTMW8	P	7.67	0.60	12.78	
6/18/97	GTFTMW9	P	2.99	1.10	2.72	
8/18/97	GTFMW1	P	1.56	0.07	22.29	Not Included in average, Results from adjacent permanent well installation
					7.68	Average Exaggeration Ratio
					6	Applied Exaggeration Ratio

Note:

(1) No baildown testing was performed at Plume 5.

Table 6-2

Free Oil Analysis Information for Plumes 5 and 6

Free Oil Recovery Project

Exxon Company, USA

Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
GTFTMW3 (Plume 6)	Moderately degraded diesel fuel #2 or fuel oil #2 type product(s)	2	86	11	11,855,300	775,300	11.9	NA
GTFTMW8 (Plume 6)	Mixture of moderately degraded diesel fuel #2 or fuel oil #2 type product(s) and gasoline range, aromatic-rich product (e.g. automotive gasoline or reformat)	13	72	15	115,250,000	41,000,000	4.7	NA
GTFTMW9 (Plume 6)	Moderately degraded diesel fuel #2 or fuel oil #2 type product(s)	2	78	19	13,134,000	164,000	24.0	NA
GTFTMW15 (Plume 6)	Moderately weathered automotive gasoline or kerosene, Jet A, JP-1, JP-5	30	64	6	NA	NA	NA	NA
GTFTMW1 (Plume 6)	NA	NA	NA	NA	NA	NA	NA	0.885
GTFSB9 (Plume 6)	NA	NA	NA	NA	NA	NA	NA	0.960
GMMW10 (Plume 6)	Moderately degraded diesel fuel/fuel oil #2 and some unique, heavier, waxy materials	NA	NA	NA	NA	NA	NA	NA
MW7 (Plume 4)	Unweathered petroleum naphtha or JP-4	40	53	7	4,318,000	297,000	1.4	0.790

Note: NA=Not Available.

Table 6-3

Soil Profile Data for Plumes 5 and 6

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

SAMPLE No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
GTFTMW1-0	0.0 - 0.8	0.86	NA	NA
GTFTMW1-2	2.0 - 2.8	7.03	36.10	0.59
GTFTMW4-0	0.0 - 1.7	0.01	13.20	0.43
GTFTMW4-2	2.0 - 3.7	0.01	14.61	0.45
GTFTMW4-4	4.0 - 5.7	47.60	11.52	0.51
GTFTMW4-6	6.0 - 7.4	7.58	33.24	0.48

Note:

(1) NA = Not Available

(2) The depth to water in GTFTMW1 (Plume 5) was approximately 4 feet below the ground surface.

The depth to water in GTFTMW4 (Plume 6) was approximately 6 feet below the ground surface.

Table 6-4

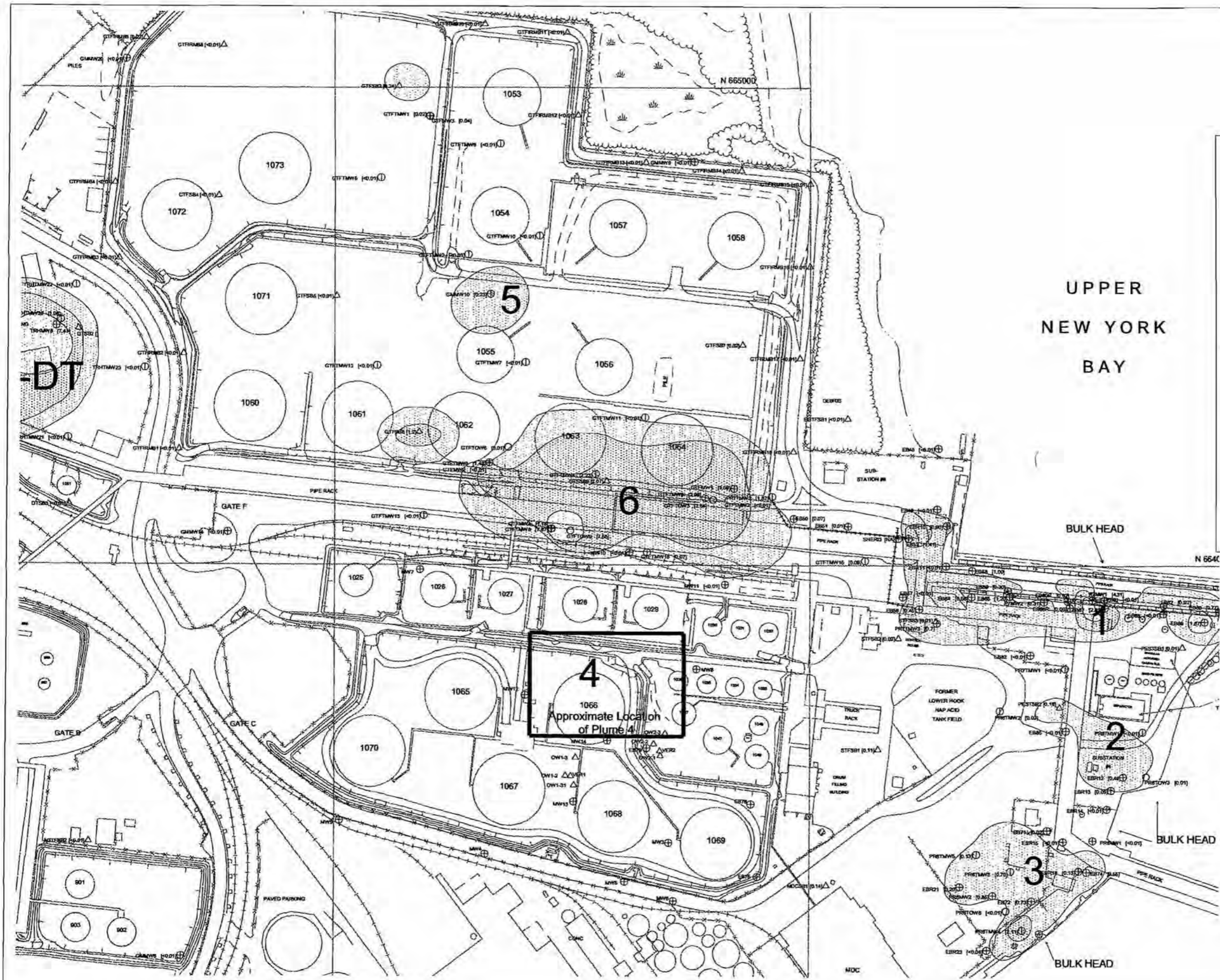
Pump Testing Results for Plume 5 and 6⁽¹⁾

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

NAPL Skimmer Tests					Total (dual) Fluids Pumping Tests							Vacuum Enhanced Total (dual) Fluids Pumping Tests								
Well ID	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)	Ground Water Pumping Rate (gpm) Q	Sustained Ground Water Drawdown (feet) s	Specific Capacity (gpm/ft of drawdown) Q/s	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)
GTFMW1 (Plume 6)	8/4/97	P	50	0.000	8/4/97 8/4/97	P P	110 115	0.002 0.010	>50 >50	7.0 8.4	1.5 4.2	4.667 2.000	8/5/97	P	255	0.030	>50	9.3	3.3	40
GTFMW4 (Plume 6)	No Test (no oil was measured in well)				No Test (no oil was measured in well)								8/7/97	P	255	0.000	>50	2.5	8.7	65
GTFMW2 (Plume 6)	No Test (no oil was measured in well)				No Test (no oil was measured in well)								No Test (no oil was measured in well)							

Notes:

(1) No pump tests were performed on plume 5.



LEGEND

- ⊕ Permanent Monitoring Well
- ⊙ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)
- EB62 [0.92] Monitoring Well I.D. with Apparent Oil Thickness
- Water Line
- 0.1 - 1 FT NAPL
- 1 - 4 FT NAPL
- >4 FT NAPL

100 0 100 200 300 400 Feet

1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK

PARSONS

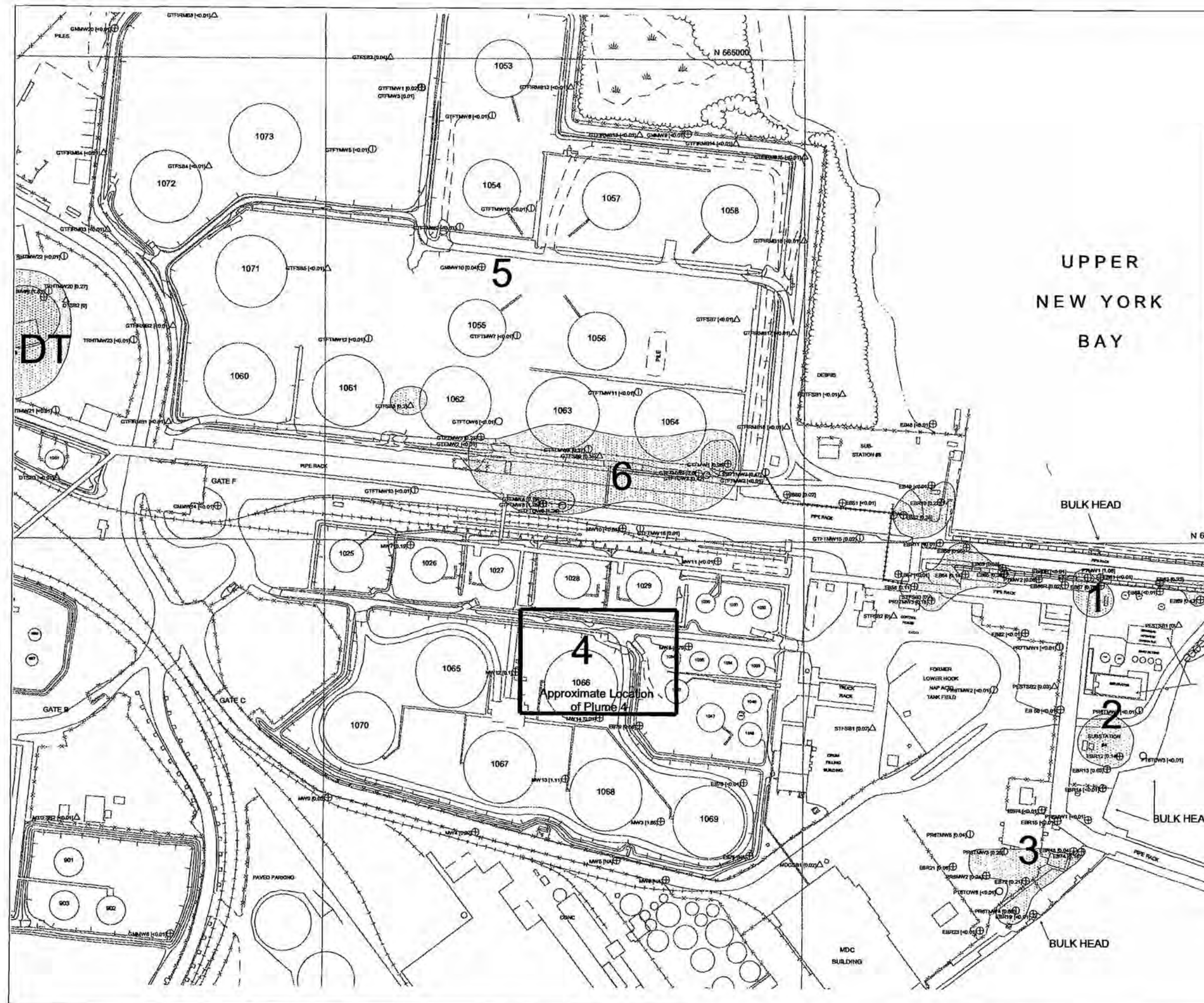
PARSONS ENGINEERING SCIENCE, INC.

EXXON

COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

Enviroental Engineering

Figure 6-1
Apparent Free Oil Thickness at
Plumes 5 and 6



LEGEND

- ⊕ Permanent Monitoring Well
- ⊙ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)
- EB62 [0.92] Monitoring Well I.D. with True Oil Thickness
- Water Line
- Approximate location of Four 4in. Dia. Perforated PVC Drains Source: RAVIV, 1995
- Approximate location of Gantry Wall
- 0.1 - 1 FT NAPL
- 1 - 4 FT NAPL
- >4 FT NAPL

100 0 100 200 300 400 Feet

1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK

PARSONS

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Figure 6-2
True Free Oil Thickness at
Plume 5 and 6

SCALE AS SHOWN

DATE March 1998

REV 1

7.0 Plume 7-AV and Plume 7-DT (AV Gas and Domestic Trade Areas)

7.1 Introduction

- In the FORP Workplan Plume 7 was depicted only in the AV Gas Area (and partially in the Asphalt Plant Area). Based on this FORP investigation findings, a second plume was confirmed in the Domestic Trade Area. Therefore, we have designated Plume 7-AV to include the original Plume 7, and Plume 7-DT as the newly confirmed plume in the Domestic Trade Area (**Figure 7-1** and **Figure 7-2**).
- The FORP Workplan did not propose any field investigation at Plume 7-DT because it was not yet confirmed as a free oil plume. Additional field work (intended to confirm the absence of a defined free oil in the area) proved that a plume did exist and, therefore, it was established as Plume 7-DT.
- The AV Gas Tank Field consists of 10 above ground tanks in two bermed areas. When Exxon operated the tanks, they contained kerosene, aviation gasoline, toluene, hexane, heptane, and cutback naphtha (Geraghty & Miller, 1994). From 1932 through 1947, the AV Gas Tank Field contained tanks and a process area that extended westward into the No. 2 Tank Field. This process area contained a vacuum furnace, an atmospheric furnace, heaters, a stack, a still, a scrubber, and a blower. From 1957 through 1961, a tetraethyl lead building was located just east of the pitch filling plant.
- Currently, the Domestic Trade Area consists of three buildings, including a gatehouse, a covered truck rack, and a garage. One heating oil underground storage tank is in service near the gatehouse (Geraghty & Miller, 1994). Historically, retail distribution of fuels occurred in the Domestic Trade Area, and operation of a series of cracking coils, as part of the refinery.
- The Asphalt Plant Area consisted of approximately 41 ASTs in four concrete-curbed areas and two soil-bermed areas. Most of the tanks contained cutback asphalt and other asphalt grades, which are not liquid at ambient temperatures. Three tanks in the soil-bermed area of the Asphalt plant contained kerosene and Varsol (a petroleum-based solvent), which are liquid at ambient temperatures. A railroad car transfer area is located in the northern portion of the Asphalt Plant Area. Asphalt, pitch, and related products were processed and handled in the Asphalt Plant Area. At that time, there were six small oil/water separators, storage sheds, a pump house, and an oxidizing plant (Geraghty & Miller, 1994).

7.2 Field Work

7.2.1 Plume 7-AV

Free Oil Delineation Tasks

- As required by the FORP Workplan, six temporary on-site wells were installed in the AV Gas Area (TRHTMW1, TRHTMW2, TRHTMW3, TRHTMW4, TRHTMW14, and TRHTMW24). NJDEP permits for the installation of these wells are included in **Appendix G**.
- Installed 1 temporary off-site well (TRHTMW16) per the Workplan.
- Installed one permanent well at the AV Gas Area (TRHWMW1). This was not included in the Workplan, but was added to provide long term data in the central portion of this plume.

- As required by the Workplan, performed 1 soil boring (TRHSB1) approximately 5 feet away from existing wells ITMW1. Collected 5 soil samples (one more than specified in the Workplan) for analysis of FORP design parameters (% residual oil, % water, porosity, and bulk density). Also, one of these soil samples collected within the oil zone on the water table was analyzed for grain size.
- Measured the apparent thickness of oil in all existing and proposed wells in the AV Gas Area in accordance with the Workplan. In total, 19 measuring events were taken.
- Performed free oil characterization on 3 samples (two more than what was specified in the Workplan). The following analyses were performed: 1) GC fingerprinting: ITMW1, GMMW3, and TRHTMW24; 2) VOA: ITMW1, and GMMW3; and 3) viscosity: ITMW1, GMMW3, and TRHTMW24.

FORP Design Support Tasks

- Three bail down tests (one more than specified in the Workplan) were performed in the AV Gas Area (ITMW1, GMMW3, and TRHTMW13).
- Performed free oil recovery rate testing at two wells (ITMW1 and TRHWMW1) (one more than specified in the Workplan).
- Prior to the test at ITMW1, installed three observation wells at 5, 10, and 50 foot intervals from the well (TRHTOW1 through 3). Performed free oil skimmer testing and total dual fluids pumping at ITMW1. No vacuum enhanced testing was performed because the cut-off criteria of 0.1 gpm was met with the dual fluids pump test.
- Prior to the test at TRHWMW1, installed three observation wells at 5, 10, and 50 foot intervals from the well (TRHTOW4 through 6). Performed total dual fluids and vacuum enhanced pumping tests at TRHWMW1.
- Evaluated the existing free oil recovery system (i.e., Interceptor Trench) with respect to its potential to capture the free oil plume in accordance with the Workplan.

7.2.2 Plume 7-DT

The Workplan did not include any field investigation in this area, however, the work described below was performed to investigate Plume 7-DT.

Free Oil Delineation Tasks

- Six temporary on-site wells were also installed in the Domestic Trade Area (TRHTMW15, TRHTMW20, TRHTMW21, TRHTMW22, TRHTMW23, and TRHTMW26). NJDEP permits for the installation of these wells are included in **Appendix H**.
- Installed two permanent monitoring wells (TRHWMW2 and TRHWMW6).
- Measured the apparent thickness of oil in the existing and the new wells in the Domestic Trade Area. In total, 16 measuring events were taken.

- Performed free oil characterization on 2 samples. The following analyses were performed: 1) GC fingerprinting: TRHTMW15 and TRHTMW20; 2) VOA: TRHTMW15 and TRHTMW20; and 3) viscosity: TRHTMW15 and TRHTMW20.

FORP Design Tasks

- Performed 2 baildown tests to determine true free oil thickness (TRHTMW15 and TRHTMW20).
- Performed free oil recovery rate testing at TRHTMW2 in the Domestic Trade Area. Prior to the test installed three observation wells at 5, 10, and 50 foot intervals from the well (TRHTOW7 through 9). Performed skimmer, total dual fluids and vacuum enhanced pumping tests at TRHTMW2.

7.3 Description of Hydrogeology

7.3.1 AV Gas Area

The hydrogeology of the AV Gas Area is summarized in the following bulleted items:

- The subsurface materials are composed of fill to depths of up to 14 feet below the ground surface. The fill consists predominantly of silt and fine sand containing slag and coal, overlying fine to very coarse sand with silt, coal, slag, concrete, bricks, wood and other debris. The presence of an organic, silt layer (i.e., peat) in several of the borings confirmed the depth to the base of the fill. According to Raviv (1995), the fill is underlain by a clay to clayey silt layer (at least five feet thick) with varying amounts of organic matter (meadow mat), sand and gravel. At well ITMW1, a seven foot thick sand layer was encountered between the fill and clay layers (Raviv, 1995).
- In the vicinity of where the thickest apparent free oil was measured at Plume 7-AV, the subsurface material near the water table consisted of very fine sand and fine sand with little to trace silt, crushed coal and slag.
- Grain size analysis of a soil sample collected from 14 feet to 15 feet in a boring performed adjacent to ITMW1 indicated that the subsurface material is fine-grained. Specifically, the sample contained approximately 51% fine sand, 19 % silt and clay, and the remaining 30 % was composed of coarser sand and gravel particles. The results of this analysis is consistent with the soil descriptions for the interval near the water table given above.
- An unconfined groundwater zone is present in the fill on-site, and groundwater in the AV Gas Area is generally between 5 ft and 7 ft below the ground surface.
- The groundwater flow direction is to the north, east and southeast (**Figure 3-1**). It is noteworthy that groundwater flow changes from a northern direction of flow in the western portion of Plume 7 to a more easterly direction of flow in the eastern portion of the plume. The hydraulic gradient is 0.004 in the AV Gas Area and 0.006 in the Domestic Trade Area.
- The unconfined groundwater zone is not influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides.

7.3.2 Domestic Trade Area

The hydrogeology of the Domestic Trade Area is summarized in the following bulleted items:

- The subsurface materials generally consist of fill to a depth of approximately 11 feet. The fill was composed of olive gray, fine sand, trace silt, and minor gravel, with slag to the east, and local areas of silt. The presence of an organic, silt layer (i.e., peat) in one of the borings confirmed the depth to the base of the fill (TRHTMW21). In the southwest portion of the area, the peat may pinch out and give way to a light brown silt (at wells TRHWM2 and TRHTWM15).
- In the vicinity of where the thickest apparent free oil was measured at Plume 7-DT, the subsurface material near the water table consisted of fine sand with a trace of silt.
- An unconfined groundwater zone is present in the fill on-site, and in the Domestic Trade Area the depth to groundwater is approximately 8 feet below the ground surface.
- The groundwater flow direction is to the north-northeast toward the General Tank Field (**Figure 3-1**).
- The unconfined groundwater zone is not influenced by tidal fluctuations based on an analysis of depths to water taken at low and high tides.

7.4 Free Oil Delineation Results

7.4.1 Plume 7-AV

Apparent Free Oil Thickness

- Plume 7-AV is defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (**Figure 7-1**). A total of 28 wells were used for the delineation. Thus, the horizontal extent of the plume has been confirmed, and no further delineation is required.
- Plume 7-AV has two main lobes that are believed to be joined to the north, and are separated in the central and southern regions by an area where less than 0.1 feet of free oil was found. The maximum free oil thickness was 9.91 feet at ITMW1. The configuration of Plume 7-AV, as depicted in this FORP, is different from how it was depicted in the Geraghty & Miller (1995) report. The absence of free oil in temporary monitoring wells installed in this central area (TRHWM1, TRHTOW6, and TRHTMW14) indicates that this plume is not one continuous zone of free oil, but instead the free oil is distributed in two lobes that are believed to be connected to the north (**Figure 7-1**). This is also supported by the GC fingerprint data presented in a later section.

True Free Oil Thickness

- Plume 7-AV, based on its true free oil thickness, is generally similar to that for the apparent free oil plume (**Figure 7-2**). The maximum true free oil thickness was 1.65 feet at ITMW1.
- An exaggeration ratio of 6 was used for Plume 7-AV.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 7-AV was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and baildown tests completed at Plume 7-AV (**Table 7-1**). The subsurface material near the water table consisted of very fine sand and fine sand with little to trace silt, crushed coal and slag. These descriptions correspond to a soil type between a sandy loam and loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type ranges between approximately 2 and 6. In addition, the exaggeration ratios from 4 baildown tests (3 as described above and 1 existing data by Dan Raviv, 1995) ranged from 5.00 to 11.97; the average exaggeration ratio was calculated to be 9.65. The higher exaggeration ratio of 11.97 was found in a well that was installed in relatively fine-grained material (i.e., silty sand). The ratios from the baildown tests are greater than the range reported in the EPA guidance for the soil types present. Therefore, given the available data, an exaggeration ratio of 6 was used for Plume 7-AV. This exaggeration factor was applied to all of the apparent free oil thicknesses in the plume to arrive at a true free oil thickness. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix G**.

7.4.2 Plume 7-DT

Apparent Free Oil Thickness

- Plume 7-DT is defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (**Figure 7-1**). A total of 12 wells were used for the delineation. Thus, the horizontal extent of the plume has been confirmed, and no further delineation is required.
- Plume 7-DT is roughly circular in shape and occupies the west-central portion of this area. The maximum free oil thickness was 7.41 feet at TRHMW6.
- The lack of free oil in temporary well TRHMW26, which is located between the AV Gas and Domestic Trade Areas, indicates that Plume 7-AV and Plume 7-DT are not connected. This is also supported by the GC fingerprint data presented later in this section.

True Free Oil Thickness

- The true free oil thickness Plume 7-DT is circular in shape (**Figure 7-2**). The maximum true free oil thickness was 1.85 feet at TRHMW6.
- An exaggeration ratio of 4 was used for Plume 7-DT.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 7-DT was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and baildown tests completed at Plume 7-DT (**Table 7-1**). The subsurface material near the water table consisted of fine sand with a trace of silt. This description corresponds to a soil type between a fine sand and a sandy loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type ranges between approximately 2 and 4. In addition, the exaggeration ratios from two baildown tests were 2.08 and 6.00, and the average exaggeration ratio was calculated to be 4.04. The average exaggeration ratio derived using the baildown tests is within the range expected for this soil type. Therefore, given the available data, an exaggeration ratio of 4 was used for Plume 7-DT. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix H**.

7.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 7-AV and Plume 7-DT are included on **Table 7-2**. These results support the physical evidence that the Domestic Trade and AV Gas free oil plumes are separate. Further, data confirm that the Plume 7-AV Gas is comprised of two distinct lobes. Results that support this are presented below.

- The free oil samples collected from wells TRHTMW15 and TRHTMW20 in the Domestic Trade Area each contained similar mixtures of moderately weathered diesel fuel or fuel oil #2, and a gasoline range product(s). Also, their viscosities and percentages of GRO, DRO, and RRO were similar (**Table 7-2**)
- The free oil samples from ITMW1 and TRHTMW1 to the south in the AV Gas Tank Field were similar mixtures of moderately weathered kerosene/diesel #1 range product(s) and an unidentified lower boiling, gasoline range product(s). These similarities argue that the sources for these oils are related. The viscosity of the free oil from well ITMW1 was similar to samples from the Domestic Trade Area.
- The absence of free oil in well TRHTMW26, which is located between the two plumes, indicates that they are separate, even though the presence of unusual compounds eluting in the vicinity of pristane and 5 α -androstane in wells TRHTMW15 and TRHTMW20 (north of railroad tracks), and in wells ITMW1 and TRHTMW1 (south of the railroad tracks) indicates that they may have similar source material.
- Free oil collected from TRHTMW24 (in the AV Gas Tank Field) contained a moderately-to-severely degraded heavy fuel oil or crude oil and it appears to be unrelated to the free oil in ITMW1 and TRHTMW1. Similarly, the mixed nature of oil from GMMW3, which is in the southern end of the western lobe of the Plume 7-AV, appears unique for the Plume 7-AV Area. The viscosities of the TRHTMW24 and GMMW3 free oil samples were similar, but they were significantly different than the free oil viscosities from the eastern lobe of Plume 7-AV and from the Domestic Trade Area (**Table 7-2**). The same relationship is true for the percentages of GRO, DRO, and RRO.
- The VOC data for the free oil samples provides additional support for the presence of a free oil plume in the AV Gas Area that is separate from the free oil plume in the Domestic Trade Area (**Table 7-2**). Generally, the free oil from each of the two areas have different total VOC concentrations. Free oil in the Domestic Trade area has an average total VOC concentration that was lower than that for the AV Gas Area. BTEX concentrations varied widely for the free oil samples.
- The specific gravity of the free oil at ITMW1 was 0.830. Free oil collected from two temporary wells during a previous study had specific gravities of approximately 0.97.
- Analyses of the vertical profile samples collected from a soil boring approximately 5 feet from well ITMW1, which had 9.91 feet apparent free oil thickness during the FORP, showed that the percent of oil and grease in the soil samples generally increased with depth to approximately 8 feet, which was near the water table (**Table 7-3**). The laboratory data for percent oil is contained in **Appendix G**.

7.6 Potential Sources of Free Oil

7.6.1 Plume 7-AV

Areas of potential sources of free oil at the AV Gas Tank Field include ASTs, former asphalt pans, oil/water separators, process areas, and sewers (Geraghty & Miller, 1994). At the Asphalt Plant Area, potential sources of free oil include ASTs, oil/water separators, drum storage areas, loading/unloading areas, a Hot Oil Transfer System, process areas, sewers, and septic systems (Geraghty & Miller, 1994).

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the AV Gas Area:

- A spill of diesel of unknown volume northwest of ITMW1 in 1992 was 80 ft upgradient of ITMW1; 9.91 feet of diesel-range free oil was found in this well.
- A 5,000 gallon spill of toluene from Tank 1010 in 1988 was in the area where 5.3 ft of apparent free oil was found in a monitoring well during the FORP (TRHTMW4). This release was in the center of what is depicted as the western lobe of Plume 7. Although no analysis was performed on the free oil from TRHTMW4, GC fingerprint data for other samples in this general area show low % GRO, and VOA analysis does not indicate the presence of significant amounts of toluene in the free oil.
- Major findings that have been reported to NJDEP include a perforated corrugated metal pipe running northwest from MH2-8 (parallel to the line from MH2-2). According to Mr. Robert Fairchild, this was installed some time prior to the construction of the Interceptor Trench in 1976 in order to aid in the collection of oil moving off the property to the north. Although it was originally installed to collect oil, it is possible that exfiltration of oil from this section has occurred.
- In the northern portion of the Asphalt Plant Area there has not been a known free oil spill event, and based on sewer inspections, no significant sewer breaks were noted on the northern lateral (Lateral 3F) of Main Sewer Trunk Line #3.

7.6.2 Plume 7-DT

The operational history of the Domestic Trade Area included retail distribution of fuels with a multiple truck loading rack, a cracking coil area occupying the northern half of the Domestic Trade Area from 1932 to 1940, and associated tanks (Geraghty & Miller (1994). The central portion of the crack coil area and portions of the truck loading rack overlap the greatest thickness of free oil found in the plume (7.41 ft at TRHWMW6), and, by physical association, these are the potential source areas.

7.7 Free Oil Pump Testing Results

Free oil pump tests were performed at wells ITMW1, TRHTMW1 in the AV Gas Area, and TRHWMW2 in the Domestic Trade Area (Table 7-4), which are non-tidal areas. The results of the tests are summarized below. The detailed results are contained in **Appendix G** and **H**.

- At well ITMW1, which is where the thickest free oil was measured at Plume 7-AV Gas, the sustained oil recovery rate for the skimmer test was 0.05 gallons per minute (gpm). For the dual fluids pump test, the maximum sustained free oil recovery rate was significantly greater, 0.92 gpm (Table 7-4). No vacuum enhanced test was performed at this well because the free oil recovery rate for the total fluids test was greater than the cut-off criteria of 0.1 gpm. During the dual fluids pump test at ITMW1, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate of 1 gpm.
- At well TRHWW1, free oil recovery could not be sustained for the dual fluids pump test or the vacuum enhanced test (Table 7-4). This is likely due to the fact that this location is near the Plume 7-AV boundary where only a small free oil thickness was measured. During the dual fluids pump test at TRHWW1, the radius of groundwater influence was less than 5 feet, using a groundwater pumping rate of 0.15 gpm.
- At well TRHWW2 in the Domestic Trade Area, the vacuum enhanced dual fluids pumping test yielded the highest sustainable free oil recovery rate (0.07 gpm), while the recovery rates were lower for the skimmer and dual fluids pumping tests. The radius of influence was greater than 50 feet for the vacuum enhanced test.

7.8 Description of Existing Free Oil Recovery System

7.8.1 Plume 7-AV

- The Interceptor Trench, located to the northwest of Plume 7-AV, intercepts a portion of the western lobe of Plume 7-AV. The total length of the Trench is approximately 2,040 feet long and it is constructed of 12-inch diameter perforated vitrified-tile-pipe (VTP) installed with a gravel filter pack (Raviv, 1995); it is oriented from northwest to southeast along the northern boundary of the Main Building Area and the No. 2 Tank Field. The high points of its profile are at the ends, each end sloping towards a low collection point located approximately 700 feet from the northwestern end. Total fluids are pumped from the Trench system at Sump A and Avenue J Sump into a sewer line that discharges to the IMTT Bayonne Facility East-Side Treatment Plant. Sump A has a back-up sump (Sump B).
- The western lobe of Plume 7-AV is upgradient of the Trench according to the groundwater contour map. Based on the groundwater information, the Trench intercepts approximately 200 feet of the western lobe of the plume. However, the trench does not extend to the eastern lobe of Plume 7-AV (centered at well ITMW1). Also, the groundwater flow just beyond the eastern end of the Trench shifts from a predominately north-northwesterly direction to a easterly direction; therefore, it is unlikely that the Trench would be effective in capturing the eastern lobe of Plume 7-AV.
- Dan Raviv has conducted a performance evaluation of the Interceptor Trench system (Raviv 1995). According to this report, "The results indicate that the hydraulic influences along the length of the trench are not uniform. The western portion of the Trench system is working adequately and so are approximately 1,000 ft of the eastern portion of the trench. The remaining 400 feet of the eastern portion of the trench, although not influenced by the pumping in Sump A, is operating due to the slope (hydraulic gradient) of the Trench."

- At Plume 7-AV, Exxon monitors free oil thickness and recovers free oil (and water) from well ITMW1 two times a week using a vacuum truck. Approximately 6 gallons of oil is recovered from this well during each event according to monitoring and recovery data collected by the Exxon Site Remediation Office.

7.8.2 Plume 7-DT

Currently, there is no free oil recovery system that specifically addresses Plume 7-DT. The groundwater contours in this area indicate that there is no potential for the trench to capture the free oil in Plume 7-DT.

7.9 Conceptual Strategies for Free Oil Recovery Design

7.9.1 Plume 7-AV

- The pump test results indicate that sustained free oil recovery rates are variable at Plume 7. In the AV Gas Area, the maximum sustained free oil recovery rate was 0.92 gpm during the dual fluids pump test at well ITMW1. This relatively good recovery rate may be due to the high availability of free oil in the area surrounding the well and the relatively low viscosity of the free oil. Therefore, dual fluids pumping is one alternative that will be evaluated for free oil recovery at the eastern end of the interceptor trench, where the thickest free oil was measured (ITMW1). The radius of influence during this testing was between 10 and 50 feet.
- The Interceptor Trench is downgradient of the free oil in the western lobe of Plume 7-AV, and therefore, has the potential to capture the free oil in this location. There is no free oil recovery system in place, however, to address the eastern lobe of Plume 7-AV. Therefore, another free oil recovery alternative to be evaluated is extending the existing Interceptor trench approximately 300 feet so that it will intercept the northern portion of the eastern lobe of the plume. To address the free oil in the central and southern portions of the eastern lobe of Plume 7-AV, active total dual fluids pumping is a conceptual remedial method to be evaluated. An additional oil recovery method is necessary in this lobe because groundwater flow directions in this area shift to the east making it unlikely that an extension of the trench would be effective for this portion of the plume.
- At Plume 7-AV, other criteria that should be considered for design of a free oil recovery system are as follows: 1) Concrete abutment walls bound the AV-Gas tank field area, and the depths to the footings are unknown, 2) AV-Gas is a high density chromium contamination area, as is much of the area along the railroad right-of-way and area immediately to the east of the staging area, 3) On-going activities include flammable materials handling which has precluded equipment activities in the past, 4) Buried lumber, railroad ties, and coarse construction debris were encountered during drilling operations, and 5) There are large pipe racks, buried power, sewer, and water lines in the area.

7.9.2 Plume 7-DT

- In the Domestic Trade Area, the pump test at well TRHWMW2, indicated that the sustainable recovery rate was 0.07 gpm using vacuum enhanced dual fluids pumping. Also, the free oil in Domestic Trade had a relatively low viscosity. The radius of groundwater influence from this test was greater than 50 feet. Therefore, conceptual methods for oil recovery to be evaluated at Plume 7-DT will include vacuum enhanced dual fluids pumping.
- An extension of the eastern end of the Interceptor Trench (noted above for Plume 7-AV) would not capture Plume 7-DT, because the groundwater flow direction in the Domestic Trade Area is to the north-northeast, away from the area into which the trench would potentially be extended.
- At Plume 7-DT, criteria that should be considered for design of a free oil recovery system are as follows: 1) There are various abandoned pipes crossing in the area; unmapped and abandoned pipe lines were encountered while drilling in the area, 2) There are pipe racks and buried electrical wires near the south margin and the boundary with City property, 3) There are numerous old foundations and floors from the cracking coil area buried in region, and 4) The overhead area is generally clear.

Table 7-1

Baildown Testing Results for Plumes 7-AV and 7-DT

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 7 - Av Gas Area						
7/17/97	ITMW1	P	9.91	1.90	5.22	
1994	ITMW1	R	8.00	1.60	5.00	
7/10/97	GMMW-3	P	1.01	0.08	11.97	
7/1/97	TRHTMW13	P	4.70	0.39	11.97	at 1000 min, Product thickness 1.78 ft

9.65 Average Exaggeration Ratio

6 Applied Exaggeration Ratio

Plume 7 - Domestic Trade Area						
7/10/97	TRHTMW15	P	3.02	1.45	2.08	
8/11/97	TRHTMW20	P	1.02	0.17	6.00	

4.04 Average Exaggeration Ratio

4 Applied Exaggeration Ratio

Table 7-2

Free Oil Analysis Information for Plumes 7-AV and 7-DT

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
ITMW1 (AV Gas)	Mixture of a moderately weathered, diesel #1 and a gasoline range product(s), perhaps automotive gasoline	24	67	9	50,480,000	0	1.9	0.830
TRHWM1 (AV Gas)	Mixture of a moderately weathered, diesel #1 and a gasoline range product(s), perhaps automotive gasoline	28	61	12	NA	NA	NA	NA
GMMW3 (AV Gas)	Mixture of an aromatic solvent (e.g., xylenes), a moderately weathered diesel range product(s) (e.g., diesel fuel or fuel oil #2), and a lube oil or asphalt type product(s)	6	60	33	29,961,000	800,000	52.3	NA
TRHTMW24 (AV Gas)	Moderately to severely degraded heavy fuel oil (e.g., #6 or Bunker C) or a crude oil	2	65	33	NA	NA	52.1	NA
TRHTMW15 (Domestic Trade)	Moderately weathered diesel fuel #2 or fuel oil #2 mixed with a gasoline range product(s)	12	82	6	16,202,000	282,000	2.6	NA
TRHTMW20 (Domestic Trade)	Moderately weathered diesel fuel #2 or fuel oil #2 mixed with a gasoline range product(s)	12	79	9	17,437,000	1,077,000	3.2	NA
AGTFSB3 (AV Gas)	NA	NA	NA	NA	NA	NA	NA	0.965
AGTFSB4 (AV Gas)	NA	NA	NA	NA	NA	NA	NA	0.970

Notes:

NA - Not Available

Table 7-3

Soil Profile Data for Plume 7-AV

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
TRHSB1-2	2.0 - 2.4	1.34	NA	NA
TRHSB1-4	4.0 - 4.8	5.42	28.83	0.46
TRHSB1-8	8.0 - 8.3	5.72	NA	NA
TRHSB1-12	12.0 - 12.2	0.30	NA	NA
TRHSB1-14	14.0 - 15.0	0.18	42.23	0.54

Note:

(1) NA = Not Available

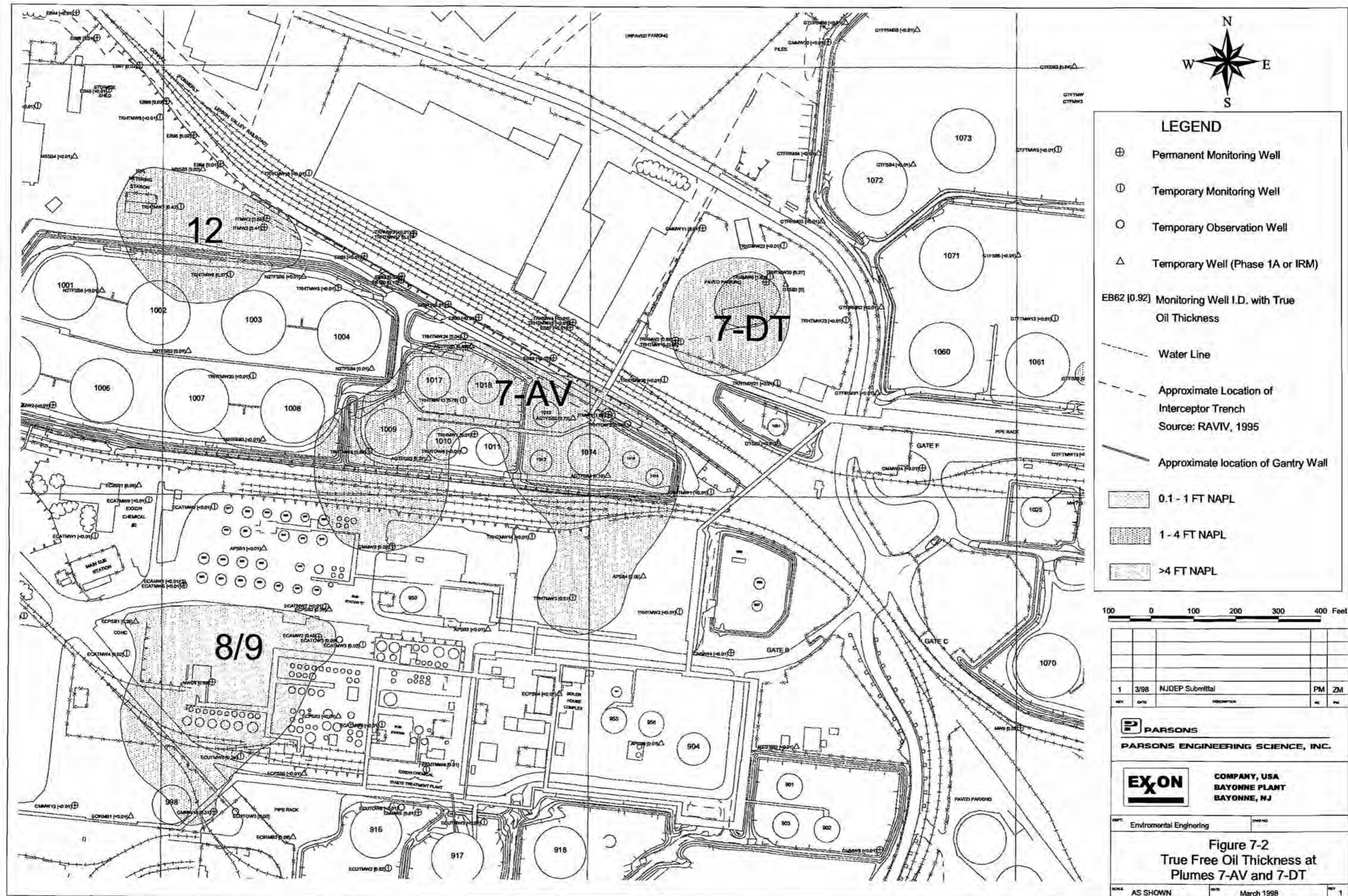
(2) The depth to water in TRHSB1 was approximately 12 feet below the ground surface

Table 7-4

Pump Test Results for Plumes 7-AV and 7-DT

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well ID	NAPL Skimmer Tests				Total (dual) Fluids Pumping Tests								Vacuum Enhanced Total (dual) Fluids Pumping Tests								
	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Specific Capacity (gpm/ft of drawdown)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)	
ITMW1 (Plume 7-AV)	7/9/97	P	394	0.050	7/10/97 7/16/97	P P	196 320	0.190 0.920	>10 >10	<50 <50	0.8 1	1.2 -4.9	0.650 NA	No Test	P	(0.1 gpm NAPL recovery rate requirement previously met)					
TRHWW2 (Plume 7-DT)	9/17/97	P	60	0.030	9/17/97 9/17/97	P P	80 60	0.020 0.020	>15 >15	<50 <50	0.08 0.1	1.2 2.7	0.067 0.037	9/17/97	P	120	0.070	>50	0.1	0.0	50
TRHWW1 (Plume 7-AV)					9/16/97	P	30	0.000	<5		0.15	4.8	0.031	9/16/97	P	60	0.000	<5	0.01	-0.8	51



8.0 Plume 11 (Main Building Area)

8.1 Introduction

- Plume 11 is located in the Main Building Area (**Figure 8-1** and **Figure 8-2**).
- The Main Building Area consists of the Main Building and adjacent parking lots, the Gate A entrance to the plant, a substation, and the IRPL metering station (Geraghty & Miller, 1994). Although this area is currently used for administrative purposes, it has historically been an active process area. Prior to the 1920s, the area was occupied by several buildings, process units, and above ground storage tanks. The process units included reducing stills, condensers, sweetening stills, stirring tanks. Several above ground storage tanks were located in the northern portion of the area, and a Paraffin Boiler House and several pump stations were located in the southwestern and central portions of the area (Geraghty & Miller, 1994).

8.2 Field Work

8.2.1 Free Oil Delineation Tasks

- Installed 5 temporary on-site wells (TRHTMW9, TRHTMW10, TRHTMW11, TRHTMW12, and TRHTMW19) for free oil delineation, which is equal to the number specified in the Workplan. Temporary well TRHTMW19 was not installed off-site as originally shown in the Workplan, but was instead installed adjacent to the northern boundary of the site. This on-site location was determined to yield information comparable to the proposed off-site well.
- As required by the Workplan, performed 1 soil boring (TRHSB3) near EB36 and collected 2 soil samples (2 less than intended in Workplan) for analysis of FORP design parameters (% residual oil, % water, porosity, and bulk density). One sample was collected within the oil zone on the water table for grain size analysis. Only two samples were collected because saturated conditions were encountered at a relatively shallow depth in the boring (approximately 5 feet) and the samples were to be collected from the vadose zone.
- Measured the apparent thickness of oil in all existing and proposed wells in the plume area, in accordance with the Workplan. A total of 8 measuring events were performed. The high viscosity of the free oil in some of the wells made it difficult to accurately gauge the apparent oil thickness.
- Performed free oil characterization on 1 sample collected from well EB34, as specified in the Workplan (EB36 was proposed but it had very little free oil). GC fingerprinting and VOA analyses were performed on sample from well EB34.

8.2.2 FORP Design Support Tasks

- Performed 2 baildown tests to determine true free oil thickness at wells EB34 and ITMW4, in accordance with the Workplan.
- Evaluated the existing free oil recovery system (i.e., Interceptor Trench) to determine its ability to capture the free oil plume, as specified in the Workplan.

8.3 Description of Hydrogeology

Relevant information about the hydrogeology of the Main Building Area at Plume 11 is presented in the following bulleted items:

- The shallow subsurface materials consist of fill, which was found to extend between 7 and 13 feet below the ground surface. The fill was generally comprised of fine sand and silt and lesser amounts of coarse sand and gravel with slag, coal and brick. The fill is underlain by brown organic material (i.e., peat/clay), which was also found in previous investigations. The peat was encountered in all five of the borings performed for the FORP in this area.
- In the vicinity where the thickest apparent free oil was measured at Plume 11, the subsurface material near the water table consisted of fine sand, trace silt, trace fine gravel.
- Grain size analysis of a soil sample collected from 3 feet to 4 feet in boring TRHSB3, which is adjacent to EB36, indicated that the subsurface material is predominantly medium sand and gravel. Specifically, the sample contained approximately 21% fine sand, 10% silt and clay, and the remaining 69% was composed of coarser sand and gravel particles. The results of this analysis is consistent with the soil descriptions for the interval near the water table given above.
- An unconfined groundwater zone is present in the fill on-site. The groundwater at the site is generally between 2 feet and 7 feet below the ground surface; the shallower depth to groundwater may have been perched water.
- The groundwater flow direction in the Main Building Area is predominantly to the north-northeast toward the Interceptor Trench (**Figure 3-1**). The hydraulic gradient in this area is 0.02. However, on the northwestern end of the Interceptor Trench, and on its northern side, groundwater flow is toward the Trench. Thus, groundwater flow converges on the Interceptor Trench in this area.
- The aquifer is not influenced by the tide based on an analysis of depths to water taken at low and high tides.

8.4 Free Oil Delineation Results

8.4.1 Apparent Free Oil Thickness Plume

- Plume 11 is defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (**Figure 8-1**). A total of 15 wells were used for the delineation. Thus, the horizontal extent of the plume has been confirmed, and no additional delineation is required.
- Plume 11 is generally globular in shape and it occurs on both sides of the Interceptor Trench. (**Figure 8-1**). The Trench, which trends in a northwest-southeast direction, bisects the plume. The maximum apparent free oil thickness was 0.9 feet in wells ITMW4 and TRHTWM19.
- It is noteworthy that the configuration of Plume 11, as depicted in this FORP, is only slightly different from how it was depicted in the Geraghty & Miller (1995) report. The presence of free oil in several temporary wells installed southwest and northeast of the plume provided justification for extending Plume 11 in these two directions (**Figure 8-1**). The plume is present on the southern and northern sides of the trench in this area, based on the free oil measurements in the wells. Also, while 2.87 feet of free oil (apparent) was measured in EB36 in 1994 (Geraghty & Miller (1995), an apparent free oil thickness of only 0.04 feet was measured in this well for the FORP.

8.4.2 True Free Oil Thickness Plume

- When true free oil thicknesses are plotted at Plume 11, the plume consists of three small areas of free oil that have a thickness of approximately 0.15 feet (**Figure 8-2**).
- An exaggeration ratio of 6 was used for Plume 11.

Derivation of Exaggeration Ratio: The exaggeration Ratio at Plume 11 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and baildown tests completed at Plume 11 (**Table 8-1**). The subsurface material near the water table consisted of fine sand, trace silt, trace fine gravel containing slag and crushed shale. We interpret these descriptions to correspond to a soil type between a sandy loam and loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type ranges between approximately 2 and 6. In addition, the exaggeration ratios from the two tests were 5.50 and 9.00, and the average exaggeration ratio was calculated to be 7.25. The average exaggeration ratio derived using the baildown tests is slightly greater than expected considering the grain size descriptions. Therefore, given the available data, an exaggeration ratio of 6 was used for Plume 11. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix I**.

8.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 11 are included on **Table 8-2**. The results are summarized below.

- The free oil sample collected from well EB34 in the northwestern end of the plume is comprised of a moderately to severely weathered heavy fuel oil product (#6 fuel oil) or crude oil. This sample had a viscosity of 29.9 cs (Raviv, 1995).
- The free oil at ITMW4 in the southeastern portion of the plume had a viscosity of 2.7 cs (Raviv, 1995), however, no GC fingerprinting was proposed at this well for the FORP.
- Because the free oil samples from the two ends of the plume have significantly different viscosities, this suggests that the plume may be composed of two types of oil.
- Analyses of profile samples collected from a soil boring approximately 5 feet from well EB36, [which had a 2.87-foot apparent thickness of free oil in 1994 (Geraghty & Miller, 1995); however, during the FORP this well had only 0.04 feet of oil] showed that the percentages of oil and grease in the two samples were 0.46 and 1.71 (**Table 8-3**). The data from these two points indicated that the percentages of oil and grease increased with depth (to 4 feet).

8.6 Potential Sources of Free Oil

Historical areas of potential releases of free oil at the Main Building Area include the above ground storage tanks, USTs, oil/water separators, process areas, sumps, and the sewers and septic systems. (Geraghty & Miller, 1994). The following bullets outline evidence for correlations between the current distribution of the free oil on-site and the potential source areas at the Main Building Area:

- No releases of oil were noted in the Main Building Area that could potentially be sources of the free oil in Plume 11.

- While no conclusive source was confirmed as the source of free oil at Plume 11 in the Main Building Area, there is one operational feature (Tanks 1 through 15 from 1940 to 1951) that overlaps the plume, and based on this geographic relationship, it is a potential source.
- There are no sewer lines near Plume 11 in the Main Building Area. The closest line is Lateral 1A of the Main Sewer Line #1, which is located approximately 180 feet south of the plume. This lateral line receives discharge from Sump A of the Interceptor Trench, and several other catch basins on the west side of the Storage Building. The lateral line is located hydraulically cross-gradient from Plume 11. No major sewer findings were interpreted for this section. Thus, Lateral 1A is not a likely source for the free oil at Plume 11.

8.7 Free Oil Pump Testing Results

No free oil pump tests were performed in the wells at Plume 11.

8.8 Description of Existing Free Oil Recovery System

The Interceptor Trench bisects Plume 11 and it has the potential to capture the free oil in the plume. The Trench is approximately 2,040 ft long and is constructed of 12-inch diameter perforated vitrified-tile-pipe (VTP) installed with a gravel filler pack (Raviv, 1995); it is oriented from northwest to southeast along the northern boundary of the Main Building Area and the No. 2 Tank Field. Total fluids are pumped from the Trench system at Sump A and Avenue J Sump, the later of which is located at the north end of Plume 11.

According to Raviv (1995), the Trench extends along the entire length of the Plume 11. Also, the groundwater flow map at Plume 11 indicates that the flow converges on the Trench. Therefore, the fact that the free oil in Plume 11 is upgradient of the trench (on both the southern and northern sides) indicates that the Trench has the potential to capture all of Plume 11.

The results of a performance evaluation are presented by Raviv (1995). According to this report, "The results indicate that the hydraulic influences along the length of the trench are not uniform. The western portion of the Trench system is working adequately and so are approximately 1,000 feet of the eastern portion of the trench. The remaining 400 feet of the eastern portion of the trench, although not influenced by the pumping in Sump A, is operating due to the slope (hydraulic gradient) of the Trench."

8.9 Conceptual Strategies for Free Oil Recovery Design

- The Interceptor Trench bisects Plume 11 and, based on the converging groundwater flow in this area, the trench will contain the free oil in Plume 11.
- Because of the convergent pattern of groundwater flow in the area of Plume 11, the most appropriate remedial method for Plume 11 is to continue to collect free oil in the existing Interceptor Trench.

Table 8-1

Baildown Testing Results for Plume 11

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 11 - Main Building Area						
7/7/97	EB34	P	0.66	0.12	5.50	
7/7/97	ITMW4	P	0.90	0.10	9.00	
					7.25	Average Exaggeration Ratio
					6	Applied Exaggeration Ratio

Table 8-2

Free Oil Analysis Information for Plume 11

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well I.D.	GC Results	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
EB34	Moderately to severely weathered heavy fuel oil product (e.g., fuel oil #5 or #6) or crude oil	3	71	26	6,900,000	0	29.9	0.922
ITMW4		NA	NA	NA	NA	NA	2.7	0.826

Table 8-3

Soil Profile Data for Plume 11

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
TRHSB3-1	1.0 - 2.2	0.46	7.45	0.37
TRHSB3-3	3.0 - 4.0	1.71	24.01	0.45

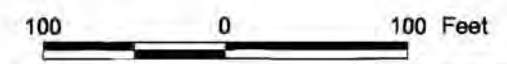
Note:

(1) The depth to water in TRHSB3 was approximately 3 feet below the ground surface.



LEGEND

- ⊕ Permanent Monitoring Well
- ⓪ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)
- ⊠ Test Pit Locations
- EB62 [0.92] Monitoring Well I.D. with Apparent Oil Thickness
- - - Approximate Location of Interceptor Trench
- . - . - Approximate Location of ICI Site Boundary
- [Stippled Pattern] 0.1 - 1.0 FT NAPL
- [Dotted Pattern] 1.0 - 4.0 FT NAPL
- [Cross-hatched Pattern] > 4.0 FT NAPL



1	1/99	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	RE	PM

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

EXXON COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

DEPT. Environmental Engineering DWG NO.

FIGURE 8-1
APPARENT FREE OIL THICKNESS
AT PLUME 11

9.0 Plume 12 (No. 2 Tank Field and Main Building Area)

9.1 Introduction

- Plume 12 is located in the No. 2 Tank Field and in the Main Building Area (**Figure 9-1** and **Figure 9-2**).
- The No. 2 Tank Field consists of eight tanks in one bermed area (Geraghty & Miller, 1994). The tanks contain No. 2 fuel oil. Prior to 1940, this area had sweetening stills and an oil/water separator associated with the stills. In addition, the entire northeastern perimeter of the No. 2 Tank Field was occupied by a line of crude stills and condensers. In 1940, there were numerous above ground storage tanks, a gas compression plant, a boiler house, a water purification plant, an oil/water separator, furnaces, and stills at the No. 2 Tank Field. The gas compression plant was previously occupied by a second line of sweetening stills (Geraghty & Miller, 1994).
- The Main Building Area is occupied by the Main Building and adjacent parking lots, the Gate A entrance to the plant, a substation, and the IRPL metering station, however, historically, the Main Building Area has been an active process area. Prior to the 1920s, the area was occupied by several buildings, process units, and above ground storage tanks. The process units included reducing stills, condensers, sweetening stills, stirring tanks. Several above ground storage tanks were located in the northern portion of the area, and a Paraffin Boiler House and several pump stations were located in the southwestern and central portions of the area (Geraghty & Miller, 1994).

9.2 Field Work

9.2.1 Free Oil Delineation Tasks

- Installed 5 temporary on-site wells (TRHTMW5, TRHTMW6, TRHTMW7, TRHTMW8, and TRHTMW25) for free oil delineation, 1 more than specified in the Workplan.
- Installed 2 temporary off-site wells (TRHTMW17 and TRHTMW18), as specified in the Workplan.
- Installed 1 off-site permanent monitoring well (TRHWMW3), in accordance with the Workplan.
- As required by the Workplan, performed 1 soil boring (TRHSB2) approximately 5 feet from ITMW2 and collected 5 soil samples for analysis of FORP design parameters (% residual oil, % water, porosity, and bulk density). One sample was collected within the oil zone on the water table for grain size analysis.
- Measured the apparent thickness of oil in all existing and proposed wells in the plume area, in accordance with the Workplan. A total of 15 measuring events were performed.
- Performed free oil characterization on 2 samples collected from wells ITMW2 and TRHTMW17 (1 more than specified in the Workplan). GC fingerprinting/VOA/viscosity analyses were performed on samples from wells ITMW2 and TRHTMW17.

9.2.2 FORP Design Support Tasks

- Performed 2 baildown tests to determine true free oil thickness at wells ITMW2 and TRHTMW6, in accordance with the Workplan.

- Evaluated the existing free oil recovery system (i.e., Interceptor Trench) to determine its ability to capture the free oil plume, as specified in the Workplan.

9.3 Description of Hydrogeology

Relevant information about the hydrogeology of the No. 2 Tank Field/Main Building Area at Plume 12 is presented in the following bulleted items:

- The shallow subsurface materials consist of fill, which was found to extend between 12 and 18 feet below the ground surface. The composition of the fill was extremely variable, but it was generally comprised of silt and fine to coarse sand, and gravel, with debris consisting of wood, slag, coal and construction materials. The fill is underlain by peat/clay layers (Geraghty & Miller 1995).
- In the vicinity where the thickest apparent free oil was measured at Plume 12, the subsurface material near the water table consisted of very fine sand with trace to little silt, containing coal and slag.
- Grain size analysis of a soil sample collected from 12 feet to 13.1 feet in boring TRHSB2, which is adjacent to ITMW2, indicated that the soil was fine-grained. Specifically, the sample contained approximately 37% fine sand, 33% silt and clay, and the remaining 30% was composed of coarser sand and gravel particles. The results of this analysis is consistent with the soil descriptions for the interval near the water table given above.
- An unconfined groundwater zone is present in the fill on-site. The groundwater at the site is generally between 5 feet and 10 feet below the ground surface.
- The groundwater flow direction in the No. 2 Tank Field and Main Building Area is consistently to the north-northeast toward the Interceptor Trench (**Figure 3-1**). The hydraulic gradient in this area is 0.02. On the north side of the trench groundwater flow is to south toward the Interceptor Trench, based on data from two off-site wells. Thus, groundwater flow converges on the Interceptor Trench in this area.
- The groundwater is not influenced by the tide based on an analysis of depths to water taken at low and high tides.

9.4 Free Oil Delineation Results

9.4.1 Apparent Free Oil Thickness Plume

- Plume 12 is defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (**Figure 9-1**). A total of 23 wells were used for the delineation. Thus, the horizontal extent of the plume has been confirmed, and no further delineation is required.
- Plume 12 occurs on the south side of the Interceptor Trench. It is generally circular in shape, however, the northern side is elongated in a northwest-southeast direction where the plume meets the Trench (**Figure 9-1**). The maximum apparent free oil thickness was 3.31 feet at ITMW2.

- The apparent thickness plume is different from how it was depicted in the Geraghty & Miller (1995) report. The presence of free oil in several temporary wells installed southwest of the former plume provided justification for extending the apparent thickness of Plume 12 to the southwest (**Figure 9-1**). This plume is not believed to extend north beyond the Trench, because free oil was not found in the wells installed on this side of the Trench; although free oil was initially detected in temporary well TRHTMW17, which was north of the trench, none was found in the permanent well (TRHWMW3) installed at the same location. Also, GC fingerprint data, which is presented in a later section, suggests that the free oil on the south side of the Trench (at well ITMW2) is different than the free oil on the north side (at well TRHTMW17).

9.4.2 True Free Oil Thickness

- Plume 12, based on its true free oil thicknesses, is oval-shaped and has a maximum free oil thickness of 0.55 feet (**Figure 9-2**).
- An exaggeration ratio of 6 was used for Plume 12.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 12 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 3 baildown tests completed at Plume 12 (**Table 9-1**). The subsurface material near the water table consisted of very fine sand with trace to little silt, containing coal and slag. These descriptions correspond to a soil type between a sandy loam and loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type ranges between approximately 2 and 6. In addition, the exaggeration ratios from the four tests ranged from 6.51 to 12.26, and the average exaggeration ratio was calculated to be 9.37. The average exaggeration ratio derived using the baildown tests is slightly greater than expected considering the grain size descriptions. Therefore, given the available data, an exaggeration ratio of 6 was used for Plume 12. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix J**.

9.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 12 are included on **Table 9-2**. These results support the physical free oil evidence from the wells that Plume 12 is likely to be located only on the south side of the Interceptor Trench and that the free oil that was detected in the temporary well north of the trench may be from a different source. However, because no free oil was found in the permanent well that was installed in the same area as the temporary well, the free oil north of the trench is likely to be discontinuous. Results that support this are presented below.

- The free oil samples collected from well ITMW2 in the No. 2 Tank Field is comprised of a slightly weathered diesel fuel #2 or fuel oil #2 product and there were little to no gasoline range compounds present. The "simple" unmixed character of this oil could be used to argue that it is part of its own small free oil accumulation. This sample had a viscosity of 8.5 cs (Raviv, 1995). Free oil from well ITMW3 had a viscosity of 5.3 cs (Raviv, 1995).
- The free oil from temporary well TRHTMW17 to the north of the Interceptor Trench contained a mixture of moderately weathered mid-heavy fuel oil and a relatively unweathered gasoline range product(s). It is unlikely that there is a common source between the oils in this well and ITMW2 based on the distinct products in these wells. The viscosity of the free oil from TRHTMW17 was 7.0 cs.

- Generally, the free oil from the two samples collected at Plume 12 had different total VOC concentrations (**Table 9-2**). The sample from ITMW2 contained one third more total VOCs compared to the sample from TRHTMW17. Also, BTEX was found only in the sample from ITMW2.
- The specific gravities of the free oil collected at wells ITMW2 and ITMW3, which are on the south side of the Trench, were 0.866.
- Analyses of soil profile samples from a soil boring approximately 5 feet from well ITMW2, which had a 2.98-foot apparent thickness of free oil during the FORP, showed that the percentages of oil and grease in six soil samples were between 1.32 and 2.71 (**Table 9-3**). The data indicated that the percentages of oil and grease were greater than 2% beginning at a depth just below the free oil in well ITMW2 (11.3 feet below the ground surface). However, when all the data are considered, there is no clear trend of increasing or decreasing oil percentages in the soil with depth.

9.6 Potential Sources of Free Oil

The operational histories of both the No. 2 Tank Field and the Main Building Area provide insight as to the potential sources of free oil at Plume 12.

9.6.1 No. 2 Tank Field

Areas of potential sources of free oil at the No. 2 Tank Field include above ground storage tanks, oil/water separators, process areas, sumps and sewers. The following bullets outline evidence for correlations between the current distribution of the free oil plumes on-site and the potential source areas identified at the No. 2 Tank Field:

- A release of fuel oil of unknown volume occurred at Tank 1005 in 1989, however, this location is not believed to be the source for the free oil at Plume 12 because it is approximately 450 feet from the current edge of the plume.
- While no conclusive sources of free oil were identified for Plume 12 in the No. 2 Tank Field, there were several operational features that were located near the thickest free oil in Plume 12, and based on this geographic relationship, they were potential sources. These features include an area of crude stills (pre-1920) that existed along the northern boundary of the No. 2 Tank Field, and two sweetening stills (pre-1920) that extended into the Main Building Area.
- Main Sewer Trunk Line #2 passes through the middle portion of the No. 2 Tank Field, approximately 120 ft south and hydraulically upgradient of the current boundary of the free oil plume. There were no major findings in this section of Trunk Line #2. Further, the configuration of the plume is not consistent with a release of free oil from the breaks in the line. In particular, one area along the western end of the line has a high number of breaks, however, a historical downgradient temporary well (N2TF6) had only 0.2 ft of free oil.

9.6.2 Main Building Area

Historical areas of potential releases of free oil at the Main Building Area include the above ground storage tanks, USTs, oil/water separators, process areas, sumps, and the sewers and septic systems. (Geraghty & Miller, 1994). The following bullets outline evidence for correlations between the current distribution of the free oil on-site and the potential source areas at the Main Building Area:

- No releases of oil were noted in the Main Building Area that could potentially be sources of the free oil in Plume 12.
- While no conclusive potential source of free oil was identified for Plume 12 in the Main Building Area, there were several operational features that were located near the thickest free oil in Plume 12, and based on this geographic relationship, they are potential sources. These features include an oil/water separator (1940) located along the Interceptor Trench, and sweetening stills (1920 through 1945)
- There are no sewer lines near Plume 12 in the Main Building Area. The closest line is Lateral 1A of the Main Sewer Line #1, which is located approximately 250 feet northwest of the plume. This lateral line receives discharge from Sump A of the Interceptor Trench, and several other catch basins on the west side of the Storage Building. Sump A and the catch basins that mark the upgradient end of this lateral line are located hydraulically cross-gradient from Plume 12. According to sewer inspections, the invert elevations of the lines that make up Lateral 1A immediately west of the Storage Building are above the water table and no cracks were noted in the line. Thus, these collection points and the sewer lines are not likely sources for the free oil at Plume 12.

9.7 Free Oil Pump Testing Results

No free oil pump tests were performed in the wells at Plume 12.

9.8 Description of Existing Free Oil Recovery System

The Interceptor Trench is located immediately downgradient of Plume 12 and it has the potential to capture the free oil in the plume. The Trench is approximately 2,040 feet long and is constructed of 12-inch diameter perforated vitrified-tile-pipe (VTP) installed with a gravel filler pack (Raviv, 1995); it is oriented from northwest to southeast along the northern boundary of the Main Building Area and the No. 2 Tank Field. Total fluids are pumped from the Trench system at Sump A and Avenue J Sump.

According to Raviv (1995), the Trench extends along the entire length of the northwestern edge of Plume 12. Also, the groundwater flow at Plume 12 indicates that the free oil is directly upgradient of the trench. The fact that the Plume 12 is upgradient of the trench and that the northwestern edge of the plume is elongated where it meets the Trench, indicates that the trench has the potential to capture all of Plume 12.

The results of a performance evaluation are presented by Raviv (1995). According to this report, "The results indicate that the hydraulic influences along the length of the trench are not uniform. The western portion of the Trench system is working adequately and so are approximately 1,000 feet of the eastern portion of the trench. The remaining 400 feet of the eastern portion of the trench, although not influenced by the pumping in Sump A, is operating due to the slope (hydraulic gradient) of the Trench."

9.9 Conceptual Strategies for Free Oil Recovery Design

- The Interceptor Trench is located hydraulically downgradient of Plume 12. The close proximity of the plume to the trench, and the overall configuration of the plume at its northern edge, indicates that the Trench will contain Plume 12.
- The most appropriate remedial method for Plume 12 is to continue to collect oil in the existing Interceptor Trench.

Table 9-1

Baildown Testing Results for Plume 12

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 12 - No. 2 Tank Field/Main Building Areas						
7/3/97	ITMW-2	P	3.31	0.27	12.26	
1994	ITMW-2	R	2.80	0.30	9.33	
7/1/97	TRITMW-6	P	1.59	0.24	6.51	
					9.37	Average Exaggeration Ratio
					6	Applied Exaggeration Ratio

Table 9-2

Free Oil Analysis Information for Plume 12

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
ITMW2	Slightly weathered diesel fuel #2 or fuel oil #2	4	92	4	30,667,000	927,000	8.5	0.866
ITMW3	NA	NA	NA	NA	NA	NA	5.3	0.866
TRHTMW17	Mixture of a moderately weathered mid-heavy fuel oil (e.g., fuel oil #4, #5, or #6), admixed with an unspecified, unweathered gasoline range product(s)	10	74	17	19,770,000	0	7.0	NA

Notes:

NA - Not Available.

Table 9-3

Soil Profile Data for Plume 12

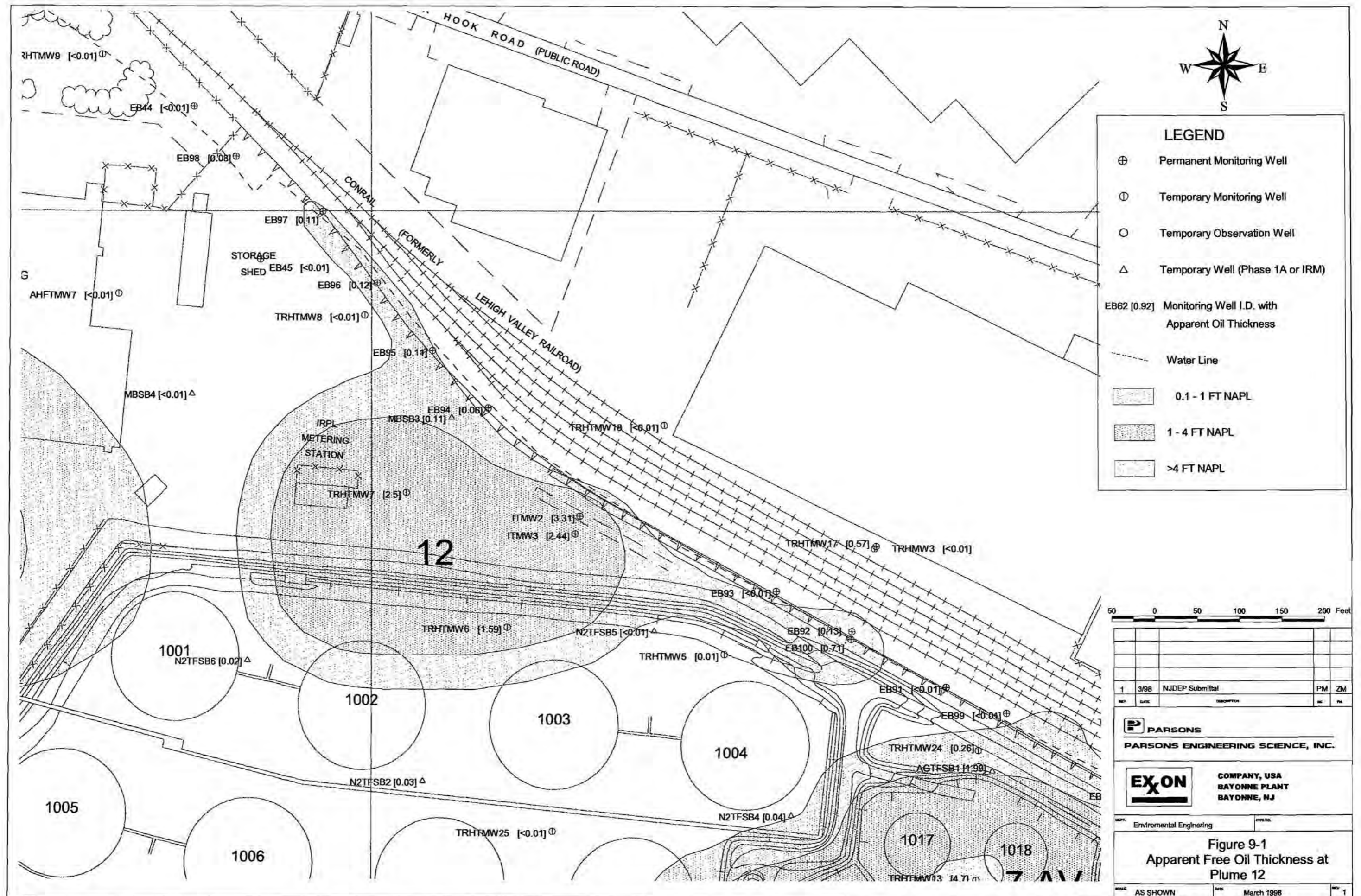
Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

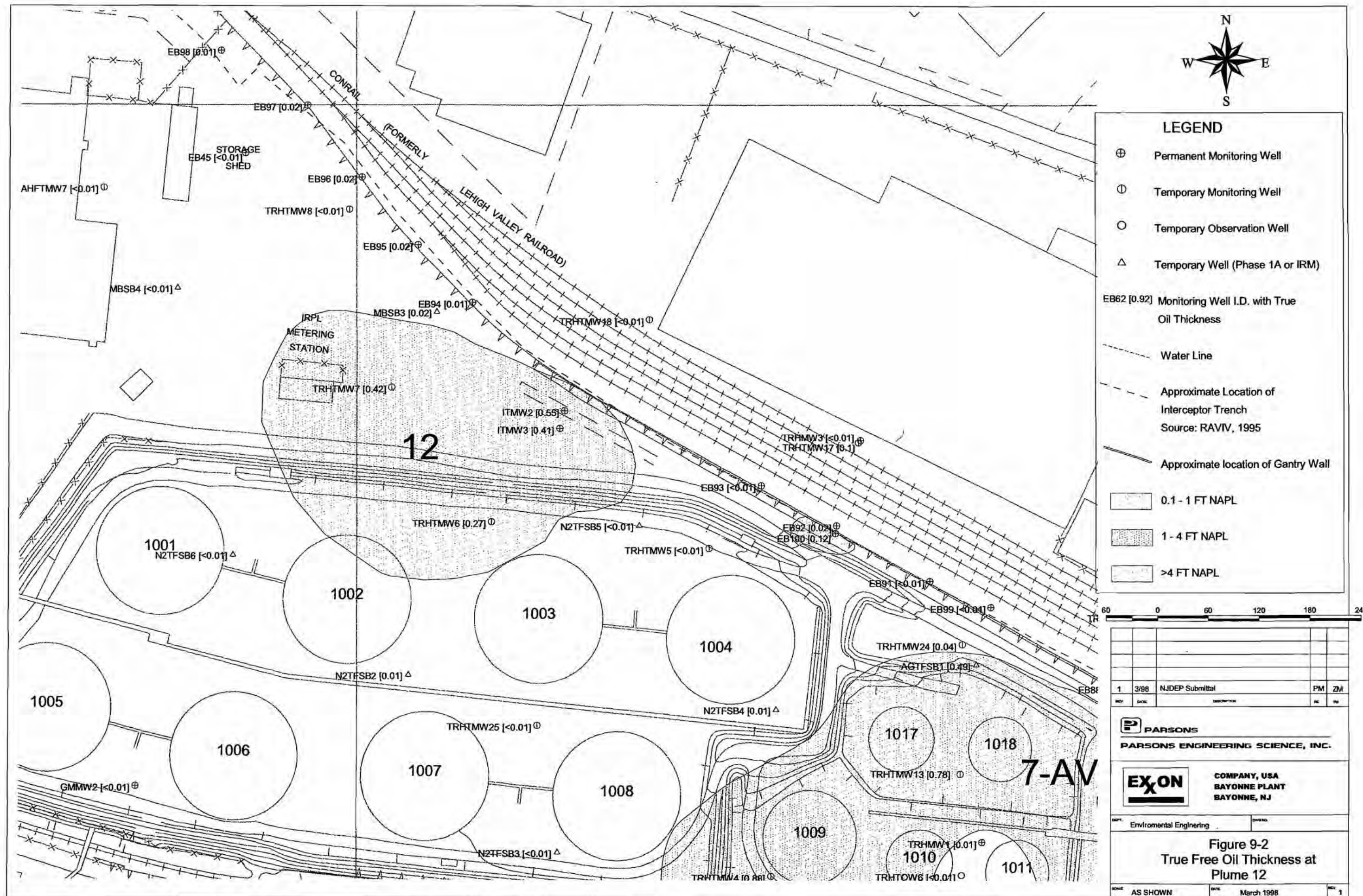
Sample #	Depth Range (feet)	Oil & Grease (%)	Moisture (%)	Porosity
TRHSB2-4	4.0 - 4.4	1.32	NA	NA
TRHSB2-6	6.0 - 6.6	2.42	24.63	0.47
TRHSB2-8	9.0 - 9.1	1.68	17.56	0.42
TRHSB2-10	10.0 - 11.1	2.41	17.79	0.32
TRHSB2-11	10.0 - 11.1	2.71	NA	NA
TRHSB2-12	12.0 - 13.1	2.19	16.54	0.37

Note:

(1) NA = Not Available

(2) The depth to water at TRHSB2 was approximately 14 feet below the ground surface.





LEGEND

- ⊕ Permanent Monitoring Well
- ⊙ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)

EB62 [0.92] Monitoring Well I.D. with True Oil Thickness

Water Line

Approximate Location of Interceptor Trench
Source: RAVIV, 1995

Approximate location of Gantry Wall

0.1 - 1 FT NAPL

1 - 4 FT NAPL

>4 FT NAPL

60 0 60 120 180 240

1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

EXXON COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

DEPT: Environmental Engineering DRAWING

Figure 9-2
True Free Oil Thickness at
Plume 12

SCALE: AS SHOWN DATE: March 1998 REV: 1

10.0 Plume 8/9 (Exxon Chemicals Plant and Utilities Area)

10.1 Introduction

- In the FORP Workplan, Plumes 8 and 9 were depicted as separate free oil plumes in the Exxon Chemicals Plant Area and Utilities Area. Based on this FORP investigation findings, these two plumes were found to be one free oil plume, and not two plumes. Therefore, in the discussion below, Plumes 8 and 9 as shown in the Workplan, have been designated as Plume 8/9 in the maps created for the FORP (**Figure 10-1** and **Figure 10-2**).
- Historically, the Exxon Chemicals Plant Area was occupied by crude stills, tanks associated with lube oil manufacturing, a series of ASTs associated with an inert gas plant, and a group of tanks for blending (Geraghty & Miller, 1995). In 1991, the Exxon Chemical Plant consisted of approximately 14 small tank fields, with a total of 90 tanks, a hazardous waste drum storage area, a chemical wastewater separator, and a building that housed the process reactor vessels. Before 1970 and after 1974, many of the process area structures in the eastern portion of the area were dismantled. During the period of 1991 through 1993, many structures in the Exxon Chemicals Plant Area were dismantled. Two sewer systems also serve the Exxon Chemicals Plant Area. A railroad car transfer area is located south of the tank farm areas.

10.2 Field Work

10.2.1 Free Oil Delineation Tasks

- Installed a total of 16 temporary wells at Plume 8/9. To investigate Plume 8 as shown in the Workplan, 9 temporary wells were installed, which is in accordance with the Workplan (ECATMW1, ECATMW2, ECATMW3, ECATMW4, ECATMW5, ECATMW6, ECATMW7, ECATMW8, and ECATMW9). To investigate Plume 9 as shown in the Workplan, 7 temporary wells were installed (2 more than specified in the Workplan) (ECUTMW1, ECUTMW2, ECUTMW3, ECUTMW4, ECUTMW5, ECUTMW6, and ECUTMW7). NJDEP permits for the installation of these wells are included in Appendix K.
- At Plume 8, installed 2 permanent wells (ECAMW1 and ECAMW2), which was in accordance with the Workplan.
- As required by the Workplan at Plume 8, collected 8 soil samples during the installation of temporary wells ECATMW6 and ECATMW7. At Plume 9, performed 1 soil boring and collected 3 soil samples (1 less than specified in the Workplan due to the relatively shallow water table). The soil samples were analyzed for FORP design parameters (% residual oil, % water, porosity, and bulk density). Also, three of these soil samples (1 more than specified in the Workplan) were collected within the oil zone on the water table for grain size analysis.
- Measured the apparent thickness of oil in all existing and proposed wells in the Exxon Chemicals Plant Area in accordance with the Workplan. In total, 13 measuring events were taken at Plume 8 wells and 23 were taken at Plume 9 wells.

- Performed free oil characterization on 4 samples, as required by the Workplan. The following analyses were performed: 1) GC fingerprinting: GMMW18, MW01, ECATMW3, and ECUTMW5; 2) VOA: GMMW18, MW01, ECATMW3, and ECUTMW5; and 3) Viscosity: GMMW18, MW01, ECATMW3, and ECUTMW5.

10.2.2 FORP Design Support Tasks

- Performed baildown tests in a total of 4 wells at Plume 8/9. At Plume 8, performed 1 baildown test (ECAMW2) (3 less than specified in the Workplan because the plume did not cover an area as large as originally expected). At Plume 9, performed 3 baildown tests (MW01, GMMW18, and ECUTMW5) (1 more than proposed in the Workplan).
- Performed free oil recovery rate testing at 3 wells (ECAMW2, GMMW5, and GMMW18) (1 less than specified in the Workplan).
- Prior to the test at ECAMW2, installed three observation wells at 5, 10, and 50 foot intervals from the well (ECATOW1 through 3), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping, and vacuum enhanced testing at this well, as required by the Workplan.
- Prior to the test at GMMW5, installed three observation wells at 5, 10, and 50 foot intervals from the well (ECUTOW4 through 6). Performed vacuum enhanced testing at this well to determine if this method could induce oil to flow to this well, which according to a Geraghty & Miller (1995) map had 4.67 feet of oil, however, none was measured during the FORP investigation. The free oil skimmer testing and total dual fluids pumping were not performed at this well because the vacuum enhanced testing was deemed to be the most effective method.
- Prior to the test at GMMW18, installed three observation wells at 5, 10, and 50 foot intervals from the well (ECUTOW1 through 3). Performed free oil skimming test, total dual fluids pumping test, and vacuum enhanced testing at this well, as specified in the Workplan.

10.3 Description of Hydrogeology

- The subsurface materials at the Exxon Chemicals Area are composed of fill. In the northern part of the area (near the former Plume 8), the fill extended to a depth of up to 16 feet and it is composed of fine to coarse sand and gravel with some coal and slag material. Below the fill, a peat layer was encountered. In the southern portion of the area (near the former Plume 9), the fill consists of fine to coarse sand with coal, slag, and brick, but within this fill are areas of silt/clay fill (from 4 to 6 feet below ground surface). Below the silt/clay zone is fine sand. This general stratigraphy (i.e., fill overlying a peat layer) is similar to the stratigraphy presented in Geraghty & Miller (1995).
- In the vicinity where the thickest apparent free oil was measured at Plume 8/9, the subsurface material near the water table consisted of fine to coarse sand, trace silt, trace gravel with some area containing slag and crushed coal; some areas of the site also have silty layers near the water table (ECAMW2).

- Grain size analyses were performed on three samples collected near the water table in the Exxon Chemicals Plant Area. Two of the samples contained 53% and 61% of fine sand/silt/clay materials while another sample was less fine-grained and contained only 34% of these same materials. Specifically, one sample from the northern portion of the area was collected from 12.0 feet to 12.6 feet in a boring performed for the installation of temporary well (ECATMW6). This sample contained approximately 25% fine sand, 36% silt/clay, and the remaining 39% was composed of coarser sand and gravel particles. Another sample collected from 10.0 feet to 10.7 feet at ECATMW7 (in the northern portion of Plume 8/9) contained approximately 24% fine sand, 10 % silt/clay, and the remaining 66% was composed of coarser sand and gravel. The last sample was collected from 8.0 feet to 8.6 feet in boring ECUSB1 and contained 22% fine sand and 31% silt/clay and the remaining 47% was composed of coarser materials. The results of these analyses are generally consistent with the soil descriptions for the interval near the water table given above.
- An unconfined groundwater zone is present in the fill at No. 3 Tank Field, and groundwater is approximately 7 feet and 8 feet below the ground surface.
- The groundwater flow direction is to the southeast toward the Kill Van Kull Waterway (**Figure 3-1**). In the southern portion of the Exxon Chemical Plant Area, a small groundwater mound protrudes to the southeast which directs flow to the south and east, as well as to the southeast. The hydraulic gradient in this area ranges between 0.002 and 0.008.
- The unconfined groundwater zone is not influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides.

10.4 Free Oil Delineation Results

10.4.1 Apparent Free Oil Thickness

- Plume 8/9 is defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (**Figure 10-1**). A total of 33 wells were used for delineation. Thus, the horizontal extent of the plume has been confirmed, and no further delineation is required.
- Plume 8/9 is roughly circular in shape, except that it is slightly elongated to the southeast on its downgradient end (**Figure 10-1**). The maximum apparent free oil thickness was 4.05 feet at well MW01. The configuration of Plume 8/9, as depicted in this FORP, is significantly different from how it was depicted in the Geraghty & Miller (1995) report. The absence of free oil wells in the northern part of the Exxon Chemicals Plant, and the presence of free oil in well MW01, provided justification for joining these two plumes (formerly 8 and 9) into one. Also, the general shape of Plume 8/9 conforms to the expected direction of elongation based on groundwater flow, which is to the southeast.

10.4.2 True Free Oil Thickness

- Plume 8/9, based on its true free oil thicknesses, is generally similar to that for the apparent free oil plume, except that the southern extension of the plume is absent (**Figure 10-2**). The maximum true free oil thickness of 0.68 feet was at well MW01
- An exaggeration ratio of 6 was used for Plume 8/9.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 8/9 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and baildown tests completed at Plume 8/9 (**Table 10-1**). The subsurface material near the water table consisted of fine to coarse sand, trace silt, trace gravel with some area containing slag and crushed coal; some areas of the site also have silty layers near the water table (ECATMW2). These descriptions correspond to a soil type between a sandy loam and loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type ranges between approximately 2 and 6. In addition, the exaggeration ratios from 4 baildown tests ranged from 6.29 to 14.82, and the average exaggeration ratio was calculated to be 8.42. The average exaggeration ratio derived using the baildown tests is greater than expected considering the grain size descriptions. Therefore, given the available data, an exaggeration ratio of 6 was used for Plume 8/9. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix K**.

10.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 8/9 are included on **Table 10-2**. Results from the characterization are presented below.

- Each of the four free oil samples collected from Plume 8/9 in the Exxon Chemicals Plant Area (GMMW18, MW01, ECATMW3, and ECUTMW5) had a distinct fingerprint, which suggests that many sources have contributed to the plume (**Table 10-2**).
- Three of the four wells considered within Plume 8/9 contained oil comprised of mixtures of different product types. The wells were ECATMW3, ECUTMW5, and MW01. A xylene-dominant gasoline range product occurred in all three wells (the product is a C8 aromatic solvent, not an automotive gasoline), which argues for a shared source within the plume. Also, ECATMW3 and MW01 each contain an unusual lube oil/asphalt product further supporting a shared source and/or continuity between these wells. However, as noted above, there are also numerous differences between these three oils. These differences tend to argue for multiple sources within Plume 8/9.
- The fourth well, GMMW18, contained oil that is distinct among the Plume 8/9 wells studied. This well, located at the southern boundary of the property, contained a moderately weathered diesel fuel #2/fuel oil #2 that was not observed in the other Plume 8/9 wells. This suggests that this well has a distinctive source not found at the other Plume 8/9 well locations.
- The viscosities of these four samples are all very different. Generally, the percentages of GRO, DRO, and RRO in three of the four samples (MW01, ECATMW3, and ECUTMW5) are similar, while the percentages of DRO and RRO for sample GMMW18 are different from the other three (**Table 10-2**).
- The volatile organic compound (VOC) concentrations were different in all four samples at Plume 8/9 (GMMW18, MW01, ECATMW3, and ECUTMW5), which also suggests that multiple sources of oil are likely at Plume 8/9.
- The specific gravity of oil from wells GMMW18 and GMMW5 are 0.870 and 0.853, respectively.

- Analyses of soil profile samples at boring ECATMW6 (north of Plume 8/9) the subsurface soil samples contained decreasing percentages of oil with depth, however, the percentages were all below 1%. At ECATMW7, in the northeastern portion of Plume 8/9, the percentage of oil in soil was similar (between 4% and 6%) from 4 feet to 10 feet below the ground surface; the nature of this profile suggests that this location is in or near a source area. At boring ECUSB1, the % oil was approximately 2% at the surface and decreased dramatically (between 0.04% and 0.15%) at 6 feet and 8 feet. This boring was performed near well GMMW5, which had 4.67 feet of oil on the Geraghty & Miller map (1995), but had only 0.05 feet during the FORP.

10.6 Potential Sources of Free Oil

Historical areas of potential sources of free oil at the Exxon Chemicals Plant include above ground storage tanks, USTs, drum storage areas, loading and unloading areas, process areas, sumps, and sewer and septic systems (Geraghty & Miller, 1994). Also, seven spills greater than 100 gallons have been documented at the Exxon Chemicals Plant Area. The materials spilled have been a variety of Exxon formulas, cyclohexane, and slop oil. The known volumes spilled ranged from 100 gallons to 6,000 gallons.

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the Exxon Chemicals Plant Area:

- The thickest apparent free oil (4.05 feet at MW01) is associated with an area of the site that was occupied by several operations/processes, most notably a filling shed (1945), a drum storage area, and Paraflo stills (1960), however, there is no documentation of a release of oil from these operations.
- In 1988, a 6,000-gallon release of cyclohexane occurred at Tank 736, which is located in the east-central portion of Plume 8/9. This release is, therefore, a potential source for the oil at Plume 8/9.
- In 1987, a 100-gallon spill of oil occurred at the blending and product tanks located immediately north of the railroad tracks in the central portion of the plume. This release may also have contributed to the oil in the plume.
- Main Sewer Trunk Line #3 passes through the Exxon Chemicals Plant Area. There are several portions of the main line and its laterals in the bounds of the plume for which major findings have been reported to NJDEP. These pipes are not submerged below the groundwater indicating that they may be areas that could potentially leak oil. Overall, these findings are not consistent with oil leakage from the sewers as a significant source of free oil. The majority of the findings are within upgradient portions of the plume and are not associated with apparent source areas. It is possible that the broken and missing pipe section between MH3A-6 and MH3-14 could have contributed to the observed free oil thickness at ECAMW2.

10.7 Free Oil Pump Testing Results

Free oil pump tests were performed at wells GMMW18, ECAMW1, and GMMW5 in the Exxon Chemicals Plant Area, which is a non-tidal area. The results of the tests are summarized below. The detailed results are contained in Appendix K.

- At well GMMW18, which is where approximately 1.5 feet of apparent thickness of free oil was measured during the FORP, the sustained oil recovery rates for the skimmer test, total dual fluids pumping test and the vacuum enhanced pumping test were variable (**Table 10-4**). No sustained oil recovery was achieved during both the skimmer test and vacuum enhanced test. A recovery rate of 0.001 gpm was recorded during the total dual fluids pumping test. During this test, the radius of groundwater influence was between 5 feet and 10 feet, using a groundwater pumping rate of approximately 0.7 gpm.
- At well ECAMW2, which is where a maximum of 2.7 feet of apparent thickness of free oil was measured during the FORP, the sustained oil recovery rates for the skimmer test, total dual fluids pumping test and the vacuum enhanced pumping test ranged from no recovery to 0.035 gpm, respectively (**Table 10-4**). The recovery rate was highest (0.035 gpm) for the vacuum enhanced test. During the total dual fluids test, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate of up to 0.15 gpm.
- The test at well GMMW5, which had only 0.05 apparent thickness of free oil during the FORP, was performed to determine if the test would cause additional oil to flow to the well, as this well was reported by Geraghty & Miller (1994) to have over 4 feet of oil. The testing began with the vacuum enhanced test, because this was deemed the method that would have the best chance to draw oil from the formation into the well. No sustained oil recovery was attained during this test.

10.8 Description of Existing Free Oil Recovery System

There is no existing free oil recovery system at Plume 8/9.

10.9 Conceptual Strategies for Free Oil Recovery Design

- The pump test results indicate that sustained free oil recovery rates were below 0.1 gpm at Plume 8/9. At ECAMW2, which is in the northeastern portion of the site, the maximum sustained free oil recovery rate was 0.035 gpm during the vacuum enhanced test. Another test performed at GMMW18 in the southwestern portion of the plume, indicated that the best oil recovery rate was obtained with the total dual fluids pump test, although this rate was relatively low (0.001 gpm). The radius of groundwater influence for this test was between 5 feet and 10 feet. While GMMW5 had only 0.05 feet of oil for the FORP, no oil could be induced to flow to this well using vacuum enhanced methods, even though this well contained over 4 feet of oil (apparent thickness) in 1994.
- At Plume 8/9, sustained free oil recovery is not practicable at this time, based on comparison to the 0.1 gpm oil recovery criterion. Conceptual remedial methods for oil recovery that will be evaluated, even though the yields are anticipated to be less than 0.1 gpm, include sustained total dual fluids or vacuum enhanced pumping. In addition, another conceptual remedial alternative is installation of an interceptor trench along the southern portion of the plume, immediately south of GMMW18. This would collect free oil that occurs within the plume, and it would also prevent any off-site migration of free oil.
- At Plume 8/9, other information that should be considered for design of a free oil recovery system is as follows: 1) Railroad tracks bound the area to north, south and west; (2) foundations are covered by the existing facility at many locations; (3) the area has numerous buried water, sewers, and electrical lines; (4) Plant operations can limit access to the area; and (5) Chemical plant piping extensively limits access in this area.

Table 10-1

Baildown Testing Results for Plume 8/9

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 8/9 - Chemical Plant and Asphalt Areas						
8/7/97	ECAMW2	P	2.69	0.43	6.29	
7/11/97	MW01	P	4.15	0.28	14.82	
7/9/97	GMMW18	P	1.88	0.30	6.29	
7/17/97	GMMW18	P	1.88	0.30	6.29	Not included in average
7/15/97	ECUTMW5	P	1.44	0.23	6.29	
					8.42	Average Exaggeration Ratio
					6	Applied Exaggeration Ratio

Table 10-2

Free Oil Analysis Information for Plume 8/9

Free Oil Recovery Project

Exxon Company, USA

Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
GMMW18	Moderately weathered middle distillate product, e.g., diesel fuel #2 or fuel oil #2	6	89	5	10,810,000	0	3.8	0.870
GMMW5	NA	NA	NA	NA	NA	NA	NA	0.853
MW01	Aromatic solvent (xylene) mixed with lube oil or asphalt type product(s) and possible moderately weathered crude oil background	7	51	41	26,627,000	2,190,000	36.1	NA
ECATMW3	Aromatic solvent (xylene) mixed with severely weathered automotive gasoline, and lube oil or asphalt type products	5	55	41	31,670,000	1,180,000	1.6	NA
ECUTMW5	Aromatic solvent (xylene) mixed with moderately weathered crude oil background	4	57	38	12,224,900	55,900	16.4	NA

Notes:

NA=Not Available

Table 10-3

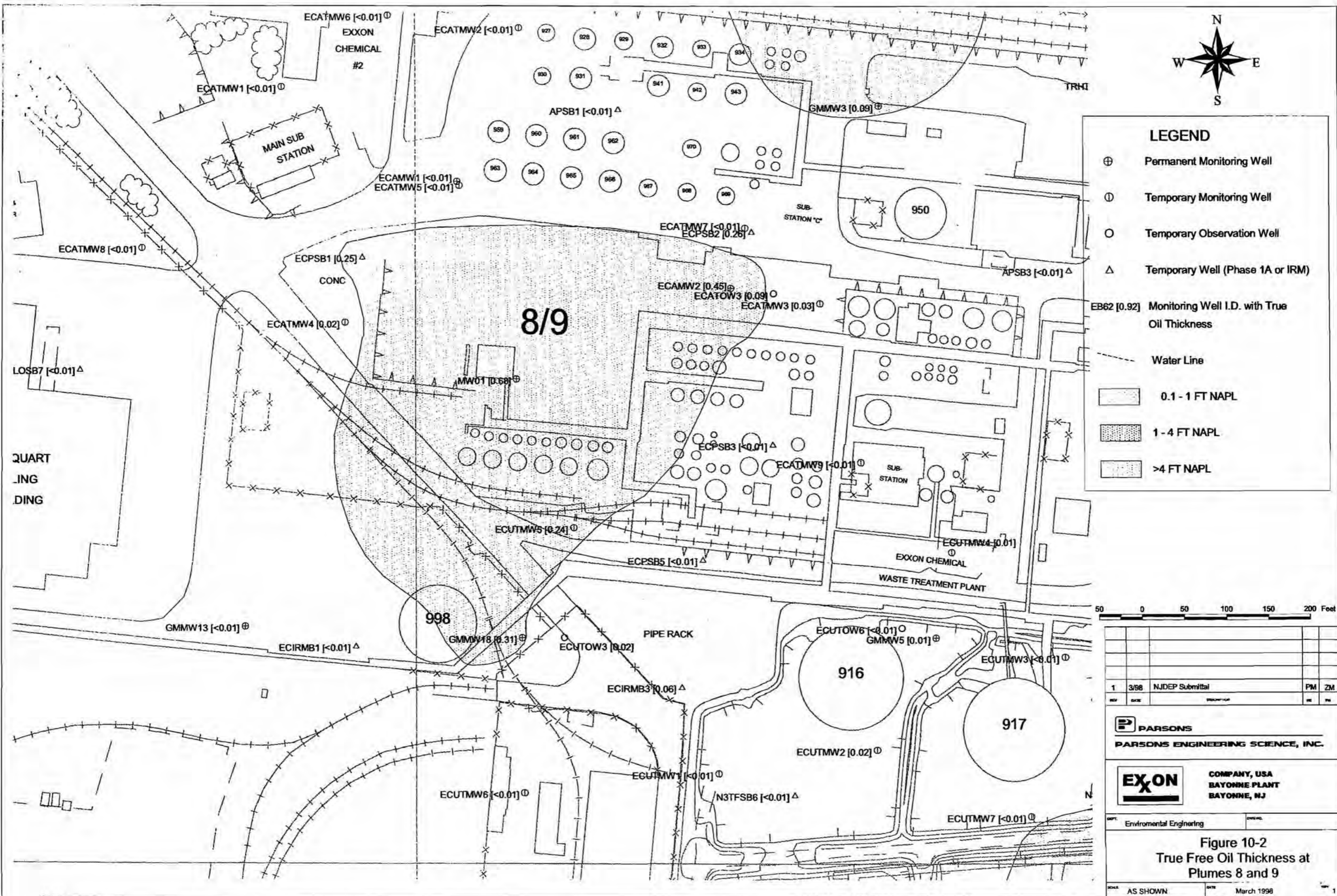
Soil Profile Data for Plume 8/9

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

SAMPLE No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
ECATMW6-2	2.0 - 3.0	0.78	35.97	0.49
ECATMW6-10	10.0 - 11.3	0.37	28.88	0.44
ECATMW6-12	12.0 - 12.6	0.05	19.12	0.35
ECATMW7-4	4.0 - 4.9	6.81	23.94	0.38
ECATMW7-6	6.0 - 6.7	6.69	4.45	0.31
ECATMW7-8	8.0 - 8.9	4.11	19.90	0.41
ECATMW7-10	10.0 - 10.7	6.32	29.19	0.51
ECATMW7-12	12.0 - 12.6	0.86	NA	NA
ECUSB1-2	2.0 - 2.8	2.03	10.10	0.44
ECUSB1-6	6.0 - 7.0	0.04	11.64	0.32
ECUSB1-8	8.0 - 8.6	0.15	12.93	0.31

Notes:

- (1) NA = Not Available
- (2) The depth to water in ECATMW6 was approximately 12.5 feet below the ground surface.
- (3) The depth to water in ECATMW7 was approximately 8 feet below the ground surface.
- (4) The depth to water in ECUSB1 was approximately 6 feet below the ground surface.



11.0 Plume 10 (No. 3 Tank Field)

11.1 Introduction

- Plume 10 exists at the No. 3 Tank Field (**Figure 11-1** and **Figure 11-2**).
- The No. 3 Tank Field consists of nine above ground tanks in three bermed areas. The tanks contained gasoline, hydrotreated light naphtha, light naphtha, asphalt, #2 fuel oil, and residual fuel oil. Since 1940, the No. 3 Tank Field has been used for storage of various liquid products. Currently, operations have not changed appreciably.

11.2 Field Work

11.2.1 Free Oil Delineation Tasks

- Four temporary on-site wells (1 more than required by the FORP Workplan) were installed in the No. 3 Tank Field (3TFTMW5, 3TFTMW6, 3TFTMW7, and 3TFTMW9). NJDEP permits for the installation of these wells are included in Appendix L.
- Installed 5 temporary off-site wells (3TFTMW1, 3TFTMW2, 3TFTMW3, 3TFTMW4, and 3TFTMW8) as specified in the Workplan.
- In December of 1998, installed two additional temporary off-site wells (3TFTMW10 and 3TFTMW11) to define the southern and southeastern extent of this plume.
- As required by the Workplan, installed 2 permanent off-site wells at the No. 3 Tank Field (3TFMW2 and 3TFMW3).
- As required by the Workplan, performed 1 soil boring (3TFSB1) near existing well GMMW7. Collected 3 soil samples (one less than specified in the Workplan due to the relatively shallow water table) for analysis of FORP design parameters (% residual oil, % water, porosity, and bulk density). Also, one of these soil samples collected within the oil zone on the water table was analyzed for grain size.
- Measured the apparent thickness of oil in all existing and proposed wells in the No. 3 Tank Field in accordance with the Workplan. In total, 26 measuring events were taken.
- Performed free oil characterization on 3 on-site samples (1 more than specified in the Workplan) and 2 off-site samples (3 less than specified in the Workplan because of the lack of free oil in off-site wells). The following analyses were performed: 1) GC fingerprinting: GMMW16, GMMW7, 3TFTMW2, 3TFTMW4, and 3TFTMW9; 2) VOA: GMMW16, GMMW7, 3TFTMW2, and 3TFTMW9; and 3) Viscosity: GMMW16, GMMW7, 3TFTMW2, 3TFTMW4, 3TFTMW4, and 3TFTMW9.

11.2.2 FORP Design Support Tasks

- In accordance with the Workplan, 6 baildown tests were performed in the No. 3 Tank Field (GMMW7, GMMW16, 3TFTMW2, 3TFTMW4, 3TFTMW6, and 3TFTMW9).

- As specified in the Workplan, performed free oil recovery rate testing at 2 wells (GMMW7 and GMMW16).
- Prior to the test at GMMW7, installed three observation wells at 5, 10, and 50 foot intervals from the well (3TFTOW4 through 6), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping, and vacuum enhanced testing at this well, as noted in the Workplan.
- Prior to the test at GMMW16, installed three observation wells at 5, 10, and 50 foot intervals from the well (TRHTOW1 through 3). Performed free oil skimmer testing and total dual fluids pumping at this well, as noted in the Workplan; vacuum enhanced testing was not necessary because the 0.1 gpm free oil recovery rate was achieved with the total dual fluids pumping.

11.3 Description of Hydrogeology

- The subsurface materials are composed of fill to depths of up to 12 feet below the ground surface. The fill consists predominantly of clay, silt, and fine sand, overlying fine to coarse sand; the fill also contains varying amounts of coal and slag material. Below the fill is an organic silt and clay (i.e., peat) layer. The presence of an organic silt and clay layer (or peat) in several of the borings performed for the FORP confirmed the depth to the base of the fill. Also, the presence of a peat layer beneath the fill was confirmed by the stratigraphy presented in Geraghty & Miller (1995); this report states that peat (or meadow mat) is at least 2 feet thick.
- In the vicinity of where the thickest apparent free oil was measured at Plume 10, the subsurface material near the water table consisted of very fine sand with trace silt, and areas entirely of silt.
- Grain size analysis of a soil sample collected from 6.0 feet to 7.2 feet in a boring performed adjacent to well GMMW7 indicated that the subsurface fill material is extremely fine-grained. Specifically, the sample contained approximately 66% fine sand, 18% silt and clay, and the remaining 16% was composed of coarser sand and gravel particles. The results of this analysis is consistent with the soil description for the interval near the water table in the borings mentioned above.
- An unconfined groundwater zone is present in the fill at No. 3 Tank Field, and groundwater is generally between 5 feet and 6 feet below the ground surface.
- The groundwater flow direction is to the south-southeast toward the Kill Van Kull Waterway (**Figure 3-1**). Also, a small groundwater mound is present immediately south of the No. 3 Tank Field. The hydraulic gradient is approximately 0.004 in the No. 3 Tank Field.
- The unconfined groundwater zone is not influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides.

11.4 Free Oil Delineation Results

11.4.1 Apparent Free Oil Thickness

- Plume 10 is defined to 0.1-foot apparent thickness contour, as required by the FORP Workplan (**Figure 11-1**). A total of 22 wells were used for the delineation. Thus, the horizontal extent of the plume on-site has been confirmed.

- Plume 10 is oval-shaped. It covers the southern portion of the No. 3 Tank Field and extends to off-site properties south of Lower Hook Road (**Figure 11-1**). The maximum free oil thickness (just over 8 feet) was measured in three wells (GMMW16, 3TFTOW3, and 3TFTMW9), all of which are located within the No. 3 Tank Field. The maximum free oil thickness in an off-site well was 7.65 (3TFTMW2). The plume is elongated in a direction that conforms to the expected direction of elongation based on groundwater flow, which is to the south-southeast.
- The configuration of Plume 10, as depicted in this FORP, is different from how it was depicted in the Geraghty & Miller (1995) report. The main difference is that now it extends off-site beyond Lower Hook Road.

11.4.2 True Free Oil Thickness

- Plume 10, based on true free oil thickness, is generally similar to that for the apparent free oil plume (**Figure 11-2**). The maximum true free oil thickness (approximately 1.5 feet) was at the same three wells that had the maximum apparent free oil thickness.
- An exaggeration ratio of 5 was used for Plume 10.

Derivation of Exaggeration Ratio: The exaggeration ratio was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and baildown tests completed at the No. 3 Tank Field (**Table 11-1**). The subsurface material near the water table consisted of very fine sand with trace silt, and areas of entirely silt. We interpret these descriptions to correspond to a soil type between sandy loam and silt loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type has a range of between approximately 2 and 8. In addition, the exaggeration ratios from 6 baildown tests were all 5.13. This exaggeration ratio is similar to what would be expected considering the grain size descriptions. Therefore, given the available data, an exaggeration ratio of 5 was used for Plume 10. This ratio is in the middle of the range cited by EPA (1996) for these types of soil. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix L**.

11.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 10 are included on **Table 11-2**. Results from the characterization are presented below.

- The free oil samples collected from 4 of the 5 wells in Plume 10 (GMMW7, 3TFTMW2, 3TFTMW4, and 3TFTMW9) each appear to contain a similar mixture of moderately weathered diesel fuel/fuel oil #2 product and an unweathered, unidentified gasoline range product(s). The similarity and proximity among these oils and wells suggests that they share common sources and are likely to be within the same plume. It is notable that the off-site well, 3TFTMW2, contained an oil related to the on-site wells (GMMW7 and 3TFTMW9). The viscosities of three of the four samples are very similar, however, the sample from 3TFTMW4 had a viscosity that was approximately nine times that of the other samples. The percentages of GRO, DRO, and RRO in these four samples were similar (**Table 11-2**).

- The free oil sample from well GMMW16 (an on-site sample) is chemically distinct from the other four samples in Plume 10. Its gasoline range component may be related to that in the other Plume 10 wells, yet the moderately weathered diesel fuel component appears to be less abundant and has a distinct Pr/Ph ratio. The latter argues that it may have had a distinct source. In addition, the GMMW16 oil contains a lube oil component that is absent from the other Plume 10 wells. The viscosity of this oil was similar to that for the other four samples. Also, this sample contained the lowest DRO percentage and the highest RRO percentage of all five samples collected in Plume 10.
- The VOC concentrations in 4 of the 5 wells in Plume 10 (GMMW7, 3TFTMW2, 3TFTMW4, and 3TFTMW9) are approximately the same. Free oil from GMMW16 contained a slightly higher concentration of total VOCs, compared to the other 4 samples. This data provides additional evidence of how the sample from GMMW16 is different than the other four samples.
- The specific gravity of oil from wells GMMW7 and GMMW16 are 0.841 and 0.830, respectively.
- Analysis of soil profile samples from a soil boring near well GMMW7, which had approximately 6 feet of apparent free oil thickness during the FORP, showed that the percent of oil and grease in the soil samples increases with depth to approximately 6 feet, which was near the water table (Table 11-3). The laboratory data for percent oil is contained in Appendix L.

11.6 Potential Sources of Free Oil

Areas of potential sources of free oil at the No. 3 Tank Field include above ground storage tanks, oil/water separators, and sewer and septic systems (Geraghty & Miller, 1994).

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the No. 3 Tank Field:

- A spill of powerformer feed (which is liquid naphtha, a light grade oil generated in the atmospheric pipe stills (Geraghty & Miller, 1995) originated at Tank 920 in the No. 3 Tank Field. This tank is located at the upgradient end of Plume 10 and is a potential source of free oil in the plume.
- An unknown volume of petroleum product was believed to have been released from Tank 916, based on a 1987 inspection that found several holes in this tank. This tank is located approximately 200 feet beyond (upgradient) the northwestern extent of Plume 10.
- Main Sewer Trunk Line #4, and many of its lateral lines, are located predominantly within the No. 3 Tank Field. Several major findings have been reported to NJDEP. Two of these findings involve poles through pipes near MH4-4, which is near the head of the plume. It is, however, entirely outside the plume boundary making it a dubious source of this substantial plume. A finding between MH4A-2 and MH4A-3 is upgradient from Tank 916, where leakage occurred. The balance of the findings are downstream of Plume 10 and are not considered potential sources.

11.7 Free Oil Pump Testing Results

Free oil pump tests were performed at wells GMMW7 and GMMW16 in the No. 3 Tank Field, which is a non-tidal area. The results of the tests are summarized below. The detailed results are contained in Appendix L.

- At well GMMW7, which is where approximately 6 feet of apparent thickness of free oil was measured, the sustained oil recovery rate for the skimmer test ranged from 0.04 to 0.12 gpm (Table 11-4). For the dual fluids pump test, the maximum sustained free oil recovery rate was approximately 0.09 gpm. The vacuum enhanced test resulted in free oil recovery rate that was two times better (0.25 gpm) than the previous two testing methods. During the dual fluids pump test at GMMW7, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate of approximately 0.05 gpm.
- At well GMMW16, free oil recovery for the skimmer test was measured at a maximum of 0.025 gpm. For the dual fluids pump test, the sustained free oil recovery rate was measured at a maximum of 0.30 gpm. For this pumping test, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate of 0.3 gpm. A vacuum enhanced test was not performed at this well because the 0.1 gpm cut-off criteria for free oil recovery was met in the dual fluids pumping test.

11.8 Description of Existing Free Oil Recovery System

There is no existing free oil recovery system at Plume 10.

11.9 Conceptual Strategies for Free oil Recovery Design

- The pump test results indicate that sustained free oil recovery rates were up to 0.30 gpm at Plume 10. At GMMW7, the maximum sustained free oil recovery rate was 0.25 gpm during the vacuum enhanced, while at GMMW16 the maximum rate of 0.30 was obtained during the dual fluids pumping test. The radius of groundwater influence during the dual fluids test was between 10 feet and 50 feet.
- At Plume 10, the most appropriate conceptual methods for oil recovery include sustained skimming, total dual fluids or vacuum enhanced pumping. Another conceptual remedial alternative is installation of an interceptor trench along the southern portion of the No. 3 Tank Field, immediately north of Lower Hook Road. This would collect free oil that occurs within the No. 3 Tank Field, and it would also prevent any further off-site migration of free oil.
- At Plume 10, other information that should be considered for design of a free oil recovery system are as follows: 1) Old foundations from now-demolished facilities, and concrete berms interfere with plume definition, (2) Large amounts of clay were hauled in to be part of the tank lining systems at the No 3. Tank Field; (3) Utility locations for Chem. South are not well known (4) Permission for access to off-site locations may be necessary for free oil recovery system installation; (5) Public utilities in Lower Hook Road (gas, water, storm sewer, domestic sewer force main), require "Dig-Safe" (or equivalent) notification and clearance before proceeding; (6) Plant operations can limit access to the No. 3 Tank Field; and (7) The #3 Tank field has been defined as an area of high density chromium contamination, with lower density contamination in other parts of the plume area.

Table 11-1

Baildown Testing Results for Plume 10

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 10 - #3 Tank Field/ Chem South						
7/9/97	GMMW7	P	5.99	1.17	5.13	
7/8/97	GMMW16	P	7.83	1.53	5.13	Not Included in average
7/11/97	GMMW16	P	7.83	1.53	5.13	
9/15/97	3TFTMW2	P	7.79	1.52	5.13	
7/8/97	3TFTMW4	P	3.09	0.60	5.13	
7/8/97	3TFTMW6	P	5.91	1.15	5.13	Not Included in average
7/11/97	3TFTMW6	P	5.91	1.15	5.13	
8/11/97	3TFTMW9	P	8.29	1.62	5.13	

5.13 Average Exaggeration Ratio

5	Applied Exaggeration Ratio
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Table 11-2

Free Oil Analysis Information for Plume 10

Free Oil Recovery Project

Exxon Company, USA

Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
GMMW16	Unspecified gasoline range product, probably not gasoline, admixed with moderately weathered diesel fuel #2 and minor lube oil/asphalt	14	62	25	26,937,000	637,000	2.1	0.830
GMMW7	Moderately weathered diesel fuel #2/fuel oil #2 admixed with an unweathered, unspecified gasoline range product, probably not gasoline	11	85	4	22,533,000	115,000	2.4	0.841
3TFTMW2	Moderately weathered diesel fuel #2/fuel oil #2 admixed with an unweathered, unspecified gasoline range product, probably not gasoline	10	74	15	17,240,000	210,000	2.3	NA
3TFTMW2Q	Moderately weathered diesel fuel #2/fuel oil #2 admixed with an unweathered, unspecified gasoline range product, probably not gasoline	10	87	3	21,828,000	88,000	2.4	NA
3TFTMW4	Moderately weathered diesel fuel #2/fuel oil #2 admixed with an unweathered, unspecified gasoline range product, probably not gasoline	13	77	10	NA	NA	19.7	NA
3TFTMW9	Moderately weathered diesel fuel #2/fuel oil #2 admixed with an unweathered, unspecified gasoline range product, probably not gasoline	18	79	3	17,215,000	684,000	2.0	NA

Notes:

NA=Not Available

Table 11-3

Soil Profile Data for Plume 10

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
3TFSB1-2	2.0 - 2.4	0.21	26.27	0.59
3TFSB1-4	4.0 - 4.6	3.55	19.88	0.49
3TFSB1-6	6.0 - 7.2	11.90	18.42	0.34

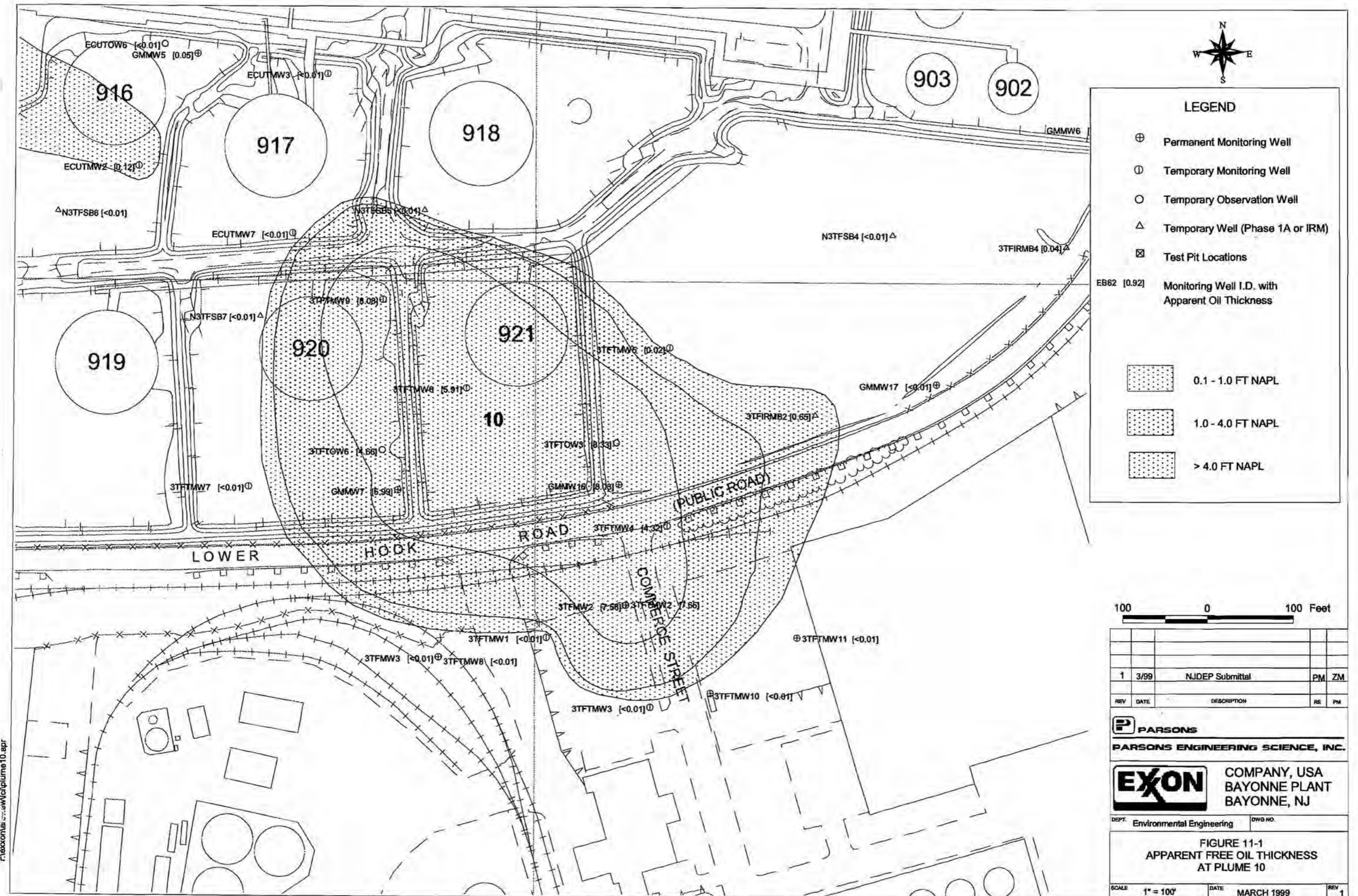
Notes:

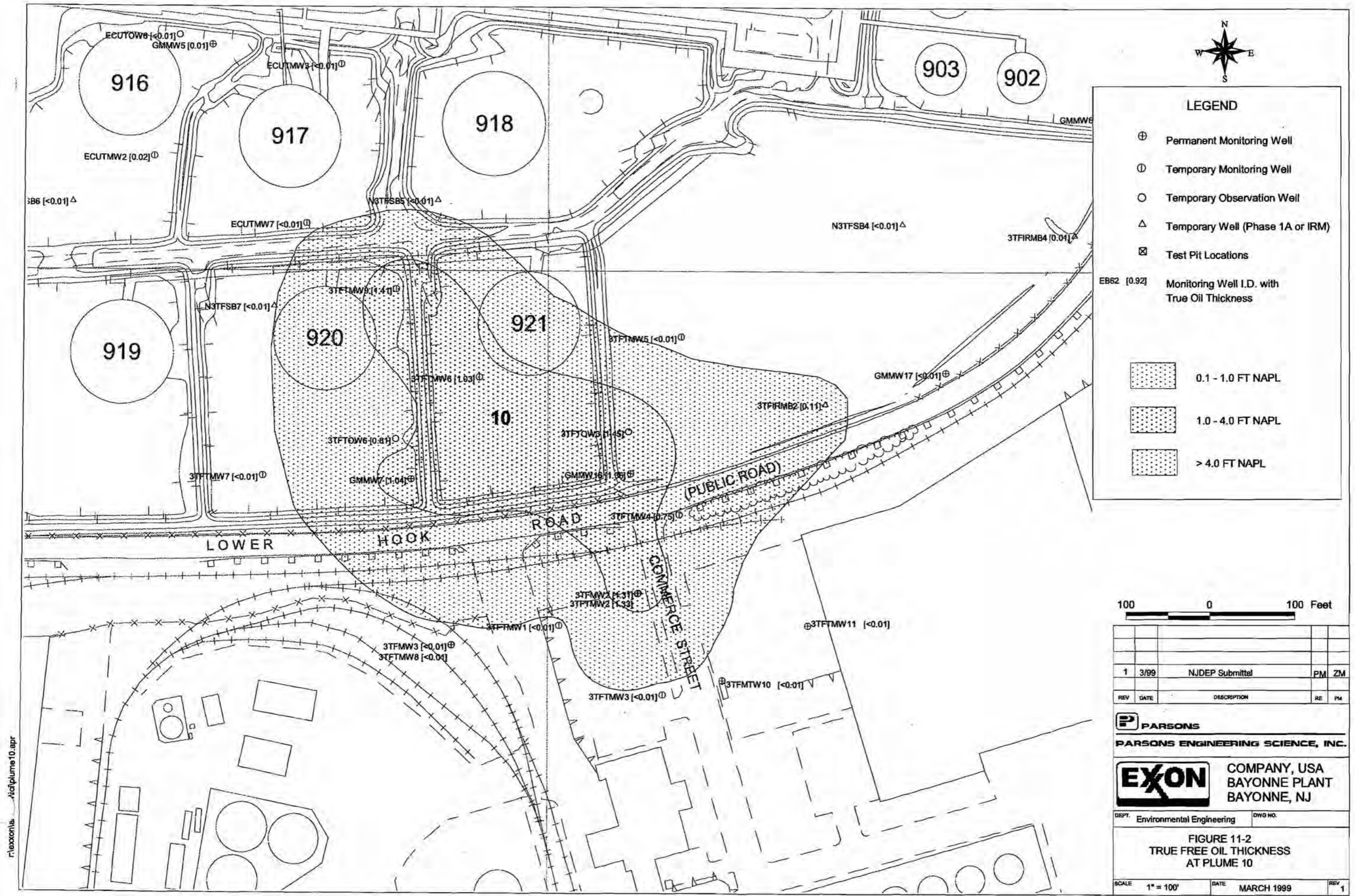
(1) Depth to water in 3TFSB1 was 6 feet below the ground surface.

Pump Testing Results for Plume 10

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

NAPL Skimmer Tests					Total (dual) Fluids Pumping Tests									Vacuum Enhanced Total (dual) Fluids Pumping Tests								
Well ID	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)		Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Specific Capacity (gpm/ft of drawdown)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)		Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)
											Q	s	Q/s									
GMMW7	7/22/97	P	110	0.120	7/29/97	P	165	0.090	>10	<50	0.04	2.3	0.017	7/30/97	P	115	0.250	>10	<50	0.06	0.2	50
	7/23/97	P	66	0.118	7/30/97	P	252	0.084	>10	<50	0.05	2.8	0.018									
	7/29/97	P	155	0.041																		
GMMW16	7/14/97	P	125	0.025	7/15/97	P	295	0.300	>10	<50	0.3	NA	NA	(Not performed because the 0.1 gpm free oil recovery rate was met with previous test)								





LEGEND

- ⊕ Permanent Monitoring Well
- ⓪ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)
- ⊠ Test Pit Locations
- EB62 [0.92] Monitoring Well I.D. with True Oil Thickness
- 0.1 - 1.0 FT NAPL
- 1.0 - 4.0 FT NAPL
- > 4.0 FT NAPL

100 0 100 Feet

REV	DATE	DESCRIPTION	RE	PM
1	3/99	NJDEP Submittal	PM	ZM

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

EXON COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

DEPT. Environmental Engineering DWG NO.

FIGURE 11-2
TRUE FREE OIL THICKNESS
AT PLUME 10

SCALE 1" = 100' DATE MARCH 1999 REV 1

Volume 10, apr

12.0 Plumes 13-AH and 13-ICI A, B, and C (A-Hill Tank Field and ICI Americas, Inc. Site)

12.1 Introduction

- Plume 13 was shown in the FORP Workplan as one plume that existed mostly in the A Hill Tank Field. However, based on the FORP investigation findings, Plume 13 is comprised of four distinct plumes, which will be referred to as Plume 13-AH, and Plumes 13-ICI A, 13-ICI B and 13-ICI C. The first plume, 13-AH, occurs in the southern portion of the A-Hill Tank Field and the Main Building Area. The second plume, 13-ICI A, which is the largest of the four plumes, occurs in the east-central area of the ICI Americas, Inc. (ICI) site and extends into the southern portion of the A Hill Tank Field, across East 22nd Street. The third plume, 13-ICI B is located on the far eastern portion of the ICI property, and is believed to be connected to Plume 11 across Avenue J. The fourth plume, 13-ICI C, is located in the northwestern portion of the ICI site in what is referred to as the non-operational area. These four plumes are shown in **Figure 12-1** and **Figure 12-2**.
- Historically, the A Hill Tank Field consisted of ten above ground tanks in three bermed areas. These tanks have contained recycled oil, stormwater overflow, #2 fuel and processed gas oil (Geraghty & Miller, 1994). These tanks were installed between 1923 and 1953. Currently, no buildings exist in the area, however, the western edge of the area is used for parking trailers. The A-Hill Tank Field has remained in the same configuration since approximately 1940 (Geraghty & Miller, 1995).
- The Main Building Area is currently occupied by the Main Building and adjacent parking lots, the Gate A entrance to the plant, a substation, and the IRPL metering station, however, historically, the Main Building Area has been an active process area. Prior to the 1920s, the area was occupied by several buildings, process units, and ASTs. The process units included reducing stills, condensers, sweetening stills, stirring tanks. Several ASTs were located in the northern portion of the area, and a Paraffin Boiler House and several pump stations were located in the southwestern and central portions of the area (Geraghty & Miller, 1994).
- Historically, the ICI site had been used for petroleum refining activities. The uses included storage, sales, transfer, and distribution of petroleum, operation of a pump house to transfer petroleum and petroleum-related products through an inter-refinery pipeline (IRPL) between Bayonne and Bayway, and deposition of waste oils and other petroleum refinery type wastes (Malcolm Pirnie, 1998). The eastern portion of the site is currently occupied by the manufacturing facilities of ICI Americas. The operations at the ICI plant began in 1965 and consisted of manufacturing of chlorinated rubber products and paraffin wax products (from 1965-1980). Subsequent manufacturing on the site included vinylisocyanurate resins, isocyanate-based polymers, and polyesters (from 1969-1986), polyurethane (from 1969-1978), and polytetrafluoroethylene (from 1969-present).

12.2 Field Work

12.2.1 Plume 13-AH [and the southern portion of Plume 13-ICI A], June - September 1997

Free Oil Delineation Tasks

- Ten temporary wells were installed in the A Hill Tank Field and the Main Building Area (AHFTMW1 through AHFTMW10) (5 more than specified in the FORP Workplan). NJDEP permits for the installation of these wells are included in Appendix M.

- Installed one permanent well at Plume 13-AH (AHFMW1), as specified in the Work Plan.
- As required by the Workplan, performed 1 soil boring (AHFSB1) near existing wells GMMW26. Collected 4 soil samples (one more than specified in the Workplan) for analysis of FORP Workplan design parameters (% residual oil, % water, porosity, and bulk density). Also, one of these soil samples collected within the oil zone on the water table was analyzed for grain size. The four samples that were proposed to be collected during the installation of the permanent well (AHFMW1) were not collected due to an oversight in the field.
- Measured the apparent thickness of oil in all existing and proposed wells in the A Hill Tank Farm in accordance with the Workplan. In total, 23 measuring events were taken.
- Performed free oil characterization on 6 samples (three more than specified in the Workplan). The following analyses were performed: 1) GC fingerprinting: GMMW26, GMMW28, AHFTMW5, AHFTMW6, AHFTMW8, and MW5S; 2) VOA: GMMW26, GMMW28, and AHFTMW5 3) Viscosity: GMMW26, GMMW28, AHFTMW5, and AHFTMW6.

FORP Design Support Tasks

- As specified in the Workplan, performed 5 bail down tests in the A Hill Tank Field (AHFTMW5, GMMW26, GMMW28, AFHTMW1, and AHFTMW4R).
- Performed free oil recovery rate testing at three wells (GMMW26, GMMW28, and AHFMW1), the same number as specified in the Workplan.
- Prior to the test at GMMW26, installed three observation wells at 5, 10, and 50 foot intervals from the well (AHFTOW1 through 3), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping, and vacuum enhanced pumping test at GMMW26.
- Prior to the test at GMMW28, installed three observation wells at 5, 10, and 50 foot intervals from the well (AHFTOW4 through 6), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping, and vacuum enhanced pumping tests at GMMW28.
- Prior to the test at AFHFW1, installed three observation wells at 5, 10, and 50 foot intervals from the well (AHFTOW7 through 9), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping and vacuum enhanced pumping tests at AHFMW1.

12.2.2 Plume 13-ICI A, B, and C [off-site at ICI Americas], October - November 1998

Free Oil Delineation Tasks

- Twenty six temporary wells were installed at the ICI site and in the A Hill Tank Field Area (ICITMW1 through ICITMW26) (1 more than specified in the FORP Workplan). NJDEP permits for the installation of these wells are included in Appendix M.
- Installed three permanent wells at Plume 13-ICI A (ICIMW1, ICIMW2, and ICIMW3), as specified in the Work Plan.

- Collected 1 soil sample within the oil zone on the water table for analysis of FORP Workplan design parameters (% residual oil, % water, porosity, bulk density, and grain size analysis) from the boring performed for the installation of well ICIMW1. The other two samples that were proposed to be collected during the installation of the permanent wells ICIMW2 and ICIMW3 were attempted, however, no samples were able to be collected at these locations using the shelby tube sampler.
- Measured the apparent thickness of oil in all existing and proposed wells in the ICI site and in the surrounding A Hill Tank Farm and Plume 11 area in accordance with the Workplan. In total, 15 measuring events were taken.
- Performed free oil characterization on 6 samples. The following analyses were performed: 1) GC fingerprinting: MW2S, MW3S, MW6S, MW11S, PZ-3, and PZ-6; 2) VOA: MW2S, MW3S, MW6S, MW11S, PZ-3, and PZ-6 3) Viscosity: MW2S, MW3S, MW6S, MW11S, PZ-3, and PZ-6.

FORP Design Support Tasks

- As specified in the Workplan, performed 12 bail down tests in the 13-ICI (A), (B) and (C) plumes (MW2S, MW3S, MW5S, MW6S, MW10S, MW11S, PZ-3, PZ-6, ICITMW2, ICITMW8, PZ-1, and ICIMW2).
- Performed free oil recovery rate testing at two wells (ICIMW2 and ICIMW3), one less than specified in the Workplan. No testing was performed at ICIMW1, because no oil flowed into this well during the entire length of the field program (this well was screened across the oil zone and it was developed; also, on multiple occasions, a vacuum was applied to the well head to try to induce oil to flow into well).
- Prior to the proposed test at ICIMW1, installed two observation wells at 10 and 50 foot intervals from the well (ICITOW1 and 2), as required by the Workplan. An existing well, MW2S, was used at the 5 foot observation well. Because no oil flowed into this well during the length of the field program, no free oil recovery testing was performed at this location.
- Prior to the test at ICIMW2, installed two observation wells at 10 and 50 foot intervals from the well (ICITOW3 and 4), as required by the Workplan. An existing well, MW2S, was used at the 5 foot observation well. Performed free oil skimmer testing at ICIMW2.
- Prior to the test at ICIMW3, installed three observation wells at 5, 10, and 50 foot intervals from the well (ICITOW5 through 7), as required by the Workplan. Performed free oil skimmer testing and total (dual) fluids pumping at ICIMW3.

12.3 Description of Hydrogeology

The hydrogeology of the A Hill Tank Field is summarized in the following bulleted items:

- The subsurface materials generally consist of fill to a depth of approximately 15 feet below the ground surface. At the A-Hill Tank Field, the fill was composed of mostly fine to medium sand with concrete fragments and brick, and in many locations the sandy fill contained a silt and clay zone that is at least 2 feet thick. The silt and clay zone was encountered between 2 feet and 7 feet below the ground surface in the FORP borings. The silt and clay zone was not encountered immediately east of the A Hill Tank Field near Gate A, and in the western portion of the Main Building Area.

- In the vicinity of where the thickest apparent free oil was measured at Plume 13-AH, the subsurface material near the water table consisted of very fine to fine sand with a trace/little of silt (AHFTMW1, 6 and 5). In the southern portion of Plume 13-ICI A the subsurface material at the water table generally consisted of fine sand and little silt overlying a mostly silt layer (AHFSB1).
- Grain size analysis of a soil sample collected near the water table (from 6.0 feet to 7.6 feet) in a boring performed adjacent to GMMW26 (Plume 13-ICI A) indicated that the subsurface material is fine-grained. Specifically, the sample contained approximately 31% silt and clay, 26% fine sand, and the remaining 44% was composed of coarser sand and gravel particles. The results of this analysis are generally consistent with the soil description from Plume 13-ICI A given above.
- An unconfined groundwater zone is present in the fill on-site, and groundwater in the A Hill Tank Field is generally between 4 feet and 6 feet below the ground surface.
- The groundwater flow direction is predominantly to the east (**Figure 3-1**). However, it is noteworthy that a groundwater divide forms in the southern portion of the A Hill Tank Field. This divide directs flow to the northeast and southwest toward the Main Building Area and the Lube Oil/Platty Kill Areas, respectively. The hydraulic gradient is approximately 0.009 in the A Hill Tank Field where flow is to the east.
- The unconfined groundwater zone is not influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides.

The hydrogeology of the ICI site is summarized in the following bulleted items:

- Based on information obtained from a 1837 map showing the Constable Hook Area of Bayonne, the northwestern and eastern portions of the ICI site were originally marsh land. The southwestern and central portions of the site was a local topographic high.
- Based on information presented in ICI Americas, Inc., Bayonne RFI Final Report (Malcolm Pirnie, 1989), and from data collected during this FORP field investigation at the ICI site, four distinct stratigraphic units were identified at the ICI site. The units consisted of fill, marsh deposits, alluvium, and till.
- The fill is the uppermost unit and it extends across the entire site and varies in thickness from 4 feet to 18.5 feet (Malcolm Pirnie, 1998). Nearly all of the borings drilled for the FORP program were almost entirely within this fill material. The thickest fill was found in the northwestern portion of the ICI site, which was previously mapped as marsh land, near the former location of the Packards Tankfield Landfill. The fill material varies in composition. In the southern portion and throughout the center of the site, it consists of a poorly sorted sand, gravel and silt. In the northwestern portions of the site it consists of poorly sorted sand, gravel and silt, some cinders and construction debris including fragment of brick, concrete, glass, and wood.
- Beneath the fill layer is a marsh deposit, however, this unit is not continuous throughout the site (Malcolm Pirnie, 1998). The deposit is a highly organic silt layer that is classified as meadow mat or peat material. It is not continuous throughout the site. According to the ICI Americas Inc. RFI Report, the peat was approximately 2 feet thick in the southeastern portion of the ICI site (MW4S), and it was nine feet thick in the northwestern portion of the site (MW8D).

- Alluvial deposits exist below the peat layer. These deposits consists of a brown to reddish brown, fine to medium sand with various percentages of silt and gravel. The alluvial deposits vary in thickness from 6 feet to 25 feet (Malcolm Pirnie, 1998).
- Till is present beneath the alluvium. It consists of a densely compacted, reddish-brown deposit of poorly sorted fine to medium grained sand with silt, clay and gravel. The till was found to be 17 feet and 25 feet thick (Malcolm Pirnie, 1998).
- In the vicinity of where the thickest apparent free oil was measured at Plume 13-ICI A, the subsurface material near the water table consisted of fine to medium sand, some silt, and little gravel with a trace of clay. Farther west in this plume (near ICIMW1) the soils are comprised of silt, some clay, and little very fine to fine sand with a trace of gravel. At Plume 13-ICI B, the subsurface materials are generally characterized as fine to medium sand, some silt, fine gravel, and peat at depth. At Plume 13-ICI C, in the northwestern portion of the ICI site, the subsurface soils generally consist of fine to coarse sand-sized cinder particles, some fine to medium gravel-sized cinder particles, brick fragments, and little silt.
- In the western portion of Plume 13-ICI A, grain size analysis of a soil sample collected near the water table (from 6.0 feet to 7.6 feet) in a boring performed at ICIMW1 indicated that the subsurface material is fine-grained. Specifically, this sample contained approximately 76% silt and clay, and the remaining 24% of the sample was composed of coarser sand and gravel particles. The results of this analysis are generally consistent with the soil descriptions from other borings around well ICIMW1 in the western portion of Plume 13-ICI A. However, on the basis of the field descriptions, the formation soils from most other parts of the ICI site are more coarse-grained than the sample at ICIMW1. Grain size analyses from other areas of Plume 13-ICI are not available due to the inability to collect undisturbed samples in the shelly tubes.
- At Plume 13-ICI A, B and C, an unconfined groundwater zone is present in the fill on-site. At Plume 13-ICI A groundwater is generally between 3 feet and 15 feet below the ground surface. At Plume 13-ICI B groundwater is generally between 4 feet and 10 feet below the ground surface. At Plume 13-ICI C groundwater is generally between 8 feet and 20 feet below the ground surface.
- The groundwater flow at the ICI site radiates from a high located in the south-central portion of the site, near East 22nd Street. Relative to this high, the ground water flow direction over most of the ICI site is predominantly to the north and east (**Figure 3-1**). A ground water divide extends from the high that exists in the south-central portion of the site. This divide runs through the central portion of the site and becomes less pronounced in the northern portion of the site, near the New Hook Access Road. In the northwestern portion of the site, in the location of the former storage lagoons, the water table is noticeably flat. In the southwestern portion of the site, where flow is to the north, the hydraulic gradient is approximately 0.019 ft/ft. In the central portion of the site, in the location of the ground water divide, and in the southeastern portion of the site, the gradient is approximately the same 0.009 ft/ft.
- The unconfined groundwater zone is not influenced by tidal fluctuations.

12.4 Free Oil Delineation Results

12.4.1 Plume 13-AH

Apparent Free Oil Thickness

- Plume 13-AH is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 12-1**). A total of 23 wells were used for the delineation. The horizontal extent of the Plume 13-AH has been confirmed, and no further delineation is required to implement the FORP.
- Plume 13-AH is an elongate plume that trends in a roughly east-west direction in the southern portion of the A Hill Tank Field. The east-west elongation of the plume is consistent with the expected directions of groundwater flow, considering that a groundwater divide exists in this area of the site. The maximum free oil thickness (9.55 feet) was measured in AHFMW1 in the eastern portion of the plume.
- Plume 13-AH is believed to extend under a portion of the Main Building, which is currently in use by site employees.
- The horizontal extent of the apparent free oil thickness of Plume 13-AH is different from how it was depicted in the Geraghty & Miller (1995) report, but the free oil apparent thicknesses are generally similar. The north-south horizontal extent is smaller because of the absence of free oil in a line of monitoring wells in the central area of the A Hill Tank Field (AHFTMW10, EB28, EB27, and AHFTMW2). This indicated that Plume 13 is not one continuous zone of free oil, but is instead two plumes (Plume 13-AH and Plume 13-ICI) (**Figure 12-1**).

True Free Oil Thickness

- Plume 13-AH, based on true free oil thickness, is generally similar to that for the apparent free oil plume (**Figure 12-2**). The maximum true free oil thickness was 1.91 feet at AHFMW1.
- An exaggeration ratio of 5 was used for Plume 13-AH.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 13-AH was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 5 baildown tests completed at the A Hill Tank Field Area (**Table 12-1**). The subsurface material near the water table consisted of very fine to fine sand with a trace/little amount of silt, which we interpret to correspond to a soil type of between sandy loam and loam, using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil between these two types has a range of between approximately 2 and 5. Furthermore, the exaggeration ratios from three baildown tests ranged from 4.07 to 8.26; the average exaggeration ratio was calculated to be 5.96. Therefore, given the available data, an exaggeration ratio of 5 was used for Plume 13-AH. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix M**.

12.4.2 Plume 13-ICI A

Apparent Free Oil Thickness

- Plume 13-ICI A is defined to 0.1-foot apparent thickness contour on the Exxon and ICI facilities, as required by the FORP Workplan, although it is clear that the majority of the plume is located on the off-site ICI property (**Figure 12-1**). A total of 43 wells were used for the delineation in both the A Hill Tank Field and the ICI property.
- The horizontal extent of the apparent thickness Plume 13-ICI A in both the A-Hill Tank Field and on the ICI site has been confirmed.
- Plume 13-ICI A is irregularly shaped and covers a relatively large area, including the ICI property to the north of the Exxon Plant and the northern portion of the A-Hill Tank Field. The maximum apparent free oil thickness was 10.08 feet, which was measured in well ICIMW2. At the A Hill Tank Field Area, the maximum thickness was 4.91 feet (in well AHFTOW3). Also, Plume 13-ICI A is not believed to commingle with Plumes 13-AH (to the south).
- The horizontal extent and apparent free oil thickness of Plume 13-ICI A is different from how it was shown in the Geraghty & Miller (1995) report.

True Free Oil Thickness

- Plume 13-ICI A, based on true free oil thickness, is generally similar, but slightly smaller, to that for the apparent free oil plume (**Figure 12-2**). The maximum true free oil thickness as 3.36 feet at ICIMW2, which is in the main employee parking lot on the ICI property.
- A conservative exaggeration ratio of 3 was used for Plume 13-ICI A. This ratio is consistent with the average of eight ratios derived from baildown testing conducted by Malcolm Pirnie (1998).

Derivation of Exaggeration Ratio: The exaggeration ratio for Plume 13-ICI A was derived using results from eight baildown tests and subsurface soil descriptions and analyses (**Table 12-1**). The average exaggeration ratio from the eight baildown tests was 3. In addition, the subsurface material near the water table consisted of fine to medium sand, some silt, and little gravel. Therefore, given the available data, a conservative exaggeration ratio of 3 was used for Plume 13-ICI A. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at these plumes are contained in **Appendix M**.

12.4.3 Plume 13-ICI B

Apparent Free Oil Thickness

- Plume 13-ICI B is defined to 0.1-foot apparent thickness contour on the ICI site, as required by the FORP Workplan. A total of 10 wells were used for the delineation on this delineation. Based on the thicknesses of oil measured in the wells, and on the types of oil observed in the wells, it is suspected that this plume is connected to the west end of Plume 11, which is on the east side of Avenue J (**Figure 12-1**). In addition, Plume 13-ICI B may also commingle with a portion of Plume 13-ICI A.
- The horizontal extent of the apparent thickness of Plume 13-ICI B on the ICI facility has been confirmed.

- Plume 13-ICI B is irregularly shaped and exists in the far eastern portion of the ICI site, along Avenue J. There is also a separate outlier portion of this plume that is located immediately to the north. The maximum apparent free oil thickness was 4.17 feet, which was measured in a well in the northern portion of this plume (ICITMW8).

True Free Oil Thickness

- Plume 13-ICI B, based on true free oil thickness, is generally similar, but smaller, to that for the apparent free oil plume (**Figure 12-2**). However, a plot of the true thickness plume indicates a general separation of plume 13-ICI A and 13-ICI B. The maximum true free oil thickness was 2.09 feet at ICIMW8.
- A conservative exaggeration ratio of 2 was used for Plume 13-ICI B.

Derivation of Exaggeration Ratio: The exaggeration ratio for Plume 13-ICI B was derived using results from subsurface soil descriptions and analyses and ratios of apparent to true free oil thickness published by EPA (1996), and 1 baildown test (**Table 12-1**). The subsurface material near the water table consisted of fine to medium sand, some silt, fine gravel (peat is found at depth at this location), which was estimate to correspond to a soil type of sandy loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type is approximately 2, which is a conservative estimate. The exaggeration ratio determined from the baildown test was 23.21, which is very high and was determined to not be representative of the oil in this plume. Therefore, given the available data, a conservative exaggeration ratio of 2 was used for Plume 13-ICI B. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at these plumes are contained in **Appendix M**.

12.4.4 Plume 13-ICI C

Apparent Free Oil Thickness

- Plume 13-ICI C is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan. While the plume's shape was based on the oil thickness measurements in the wells, it was also largely influenced by the location of the former storage lagoons, which are the suspected source of the oil (**Figure 12-1**). Plume 13-ICI C is located in the northwestern portion of the ICI site. A total of 16 wells were used for the delineation of this plume.
- The horizontal extent of the apparent thickness Plume 13-ICI C on the ICI site has been confirmed. Because the former storage lagoons extended under Route 169, it is also likely that this plume may extend under this highway.
- Plume 13-ICI C is roughly oval in shape and covers an area approximately equal to the size of the storage lagoons that used to exist in this area of the site. Given the available data and for the purposes of the FORP design, Plume 13-ICI C is depicted as one continuous plume, however, it may in reality be discontinuous. This is based on the distribution of the former lagoons and on the fact that the oil is very viscous and would not be expected to migrate a significant distance from these former lagoons. In addition, the actual plume shape (migration paths) may also be influenced by subsurface construction debris/material. The maximum apparent free oil thickness was 0.97 feet, which was measured in well MW9S.

True Free Oil Thickness

- Plume 13-ICI C, based on true free oil thickness, is generally similar to that for the apparent free oil plume (**Figure 12-2**). The maximum true free oil thickness was 0.49 feet at MW9S.
- A conservative exaggeration ratio of 2 was used for Plume 13-ICI C.

Derivation of Exaggeration Ratio: The exaggeration ratio for Plume 13-ICI C was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996); no baildown testing was performed due to the high viscosity of the oil (**Table 12-1**). The subsurface material near the water table consisted of fine to coarse sand-sized cinder particle, some fine to medium gravel-sized cinder particles, brick fragments, and little silt, which were estimated to correspond to a soil type of sandy loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type is approximately 2, which is a conservative ratio. Therefore, given the available soil description data, a conservative exaggeration ratio of 2 was used for Plume 13-ICI C. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at these plumes are contained in **Appendix M**.

12.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 13-AH and Plume 13-ICI A, B, and C are included on **Table 12-2**. The GC results help support the other information (primarily oil thickness data) that indicates that there are generally four separate oil plumes (13AH, and 13-ICI A, B, and C) in this area of the site. The free oil analytical reports (Battelle 1997 and 1998) are included in **Appendix Q**.

Plume 13-AH

- The four samples studied from Plume 13-AH (AHFTMW5, GMMW28, AHFTMW6, and AHFTMW8) contained mixtures of heavy fuel/crude oil with different amounts of variously weathered diesel fuel #2/fuel oil #2 and various amounts of the unspecified gasoline range product(s) (**Table 12-2**). The weathered heavy fuel/crude oil is the only component present in the GMMW28 sample (this was also the only component in the sample from well EB34 from nearby Plume 11, however, these two locations are not near each other).
- The specific gravity of the free oil collected from three historical temporary wells installed during a previous study (AHTFSB4, and MBSB2) was 0.820.

Plume 13-ICI A

- The NAPL samples from the southern and central portions of Plume 13-ICI A (MW-11S, PZ-3, MW3S and GMMW26) are all chemically similar in that they are comprised of a mixture of gasoline, diesel and residual range organics. Specifically, they appear to represent mixtures of (1) a light petroleum product (gasoline?), (2) a diesel fuel oil #2, and (3) a minor amount of a "background" heavy fuel/crude oil. The degree of mixing among these three products is fairly comparable. It is notable that the Pr/Ph ratios are between 2.0 and 2.6. This Pr/Ph range might indicate multiple source materials for these products, however, because of the likelihood of mixing two products containing Pr and Ph (diesel fuel oil with heavy/crude oil), this variability is not particularly significant. These four NAPLs do exhibit variable degrees of biodegradation, e.g., as measured by the *n*-C₁₈/Ph ratio (**Table 3-1** in Battelle report). The weathering trend implied by this

ratio parallels the northwest-southeast locations of each of these wells, i.e., the degree of biodegradation of the diesel range component is greatest in the MW-11S area and least in the GMMW26 area. The overall chemical similarity and apparent weathering trend among these four NAPL's suggests that they may be part of a continuous NAPL pool which spans this area and the ICI/Exxon property boundary.

- The NAPL samples from the northern portion of Plume 13-ICI A (PZ-6, MW-6S) are also chemically similar and are each comprised of moderately to-severely weathered heavy fuel oil or crude oil. This oil in these two wells is also similar to that which was found in MW34 in Plume 11. As footnoted above, this type of material could represent a variety of heavy petroleum products, including various heavy petroleum waste products (e.g., tank bottoms). The fact that these fairly widespread locations contain a comparably heavy material, along with the fact that the MW-11S, PZ-3, MW3S and GMMW26 NAPLs all contain a similar heavy component, makes it reasonable to believe that much of the ICI Americas, Inc. area contains a 'background' heavy petroleum product (heavy fuel crude oil) or heavy petroleum waste product (tank bottoms).
- While the MW2S also contains this 'background' heavy material, the nature of its diesel range product is distinct due to its more severe degree of weathering and its uniquely high Pr/Ph ratio. This suggests that the diesel fuel oil component in this area is distinct from that observed in the MW11S, PZ-3, MW3S and GMMW26 NAPLs.
- In summary, the ICI America, Inc. area is clearly heterogeneous and there is a complex history of multiple products released in multiple areas. The general character of the LNAPLs, however, suggests that there is a moderately-to-severely weathered heavy fuel/crude oil or heavy waste 'background' throughout the entire area. Superimposed on this background material are more localized sources of (1) fuel oil #2/diesel fuel #2, which are now variably weathered, and (2) some gasoline range product(s) which appear fairly unweathered.
- The variability of the volatile organic compound (VOC) data for the free oil samples provides additional support for a complex and varied history of releases of various products in this area (Table 12-2).
- The specific gravity of the free oil collected from one historical temporary wells installed during a previous study (AHTFSB1) was 0.820.
- Analysis of soil profile samples collected from a soil boring approximately 5 feet from well GMMW26, which had 1.83 feet of free oil (apparent) during the FORP, showed that the percent of oil and grease in the soil samples generally decreased with depth to approximately 4 feet, which was near the water table (Table 12-3). As noted below, the strongest evidence (including free oil thickness measurements and groundwater flow directions in this area) suggests that there is an off-site source of oil at ICI property that migrated into the A Hill Tank Field. The laboratory data for percent oil is contained in Appendix M.

Plume 13-ICI B

- There are no GC fingerprint data available for the main Plume 13-ICI B, however, based on visual similarity of the oil (dark brown-black with a relatively high viscosity) this plume is believed to be related to the oil found in Plume 11, across Avenue J. The ground water flow direction at Plume 13-

ICI B, which is toward the end of the Interceptor Trench at Plume 11, provides support for the connection of the oil found at Plume 13-ICI B and Plume 11.

- The NAPL from the MW55 well (and outlier area immediately north of Plume 13-ICI B), which was previously studied, continues to stand alone. This sample contains predominantly suspected PAH compounds. It is clearly distinct from the other NAPL's in the ICI Americas, Inc. area and, most likely, derived from a predominantly non-petroleum source (i.e., it is a coal-derived liquid).

Plume 13-ICI C

- GC fingerprint data collected during a field investigation of the northwestern area of the ICI property by Malcolm Pirnie (1998) indicate that the oil in this area is a heavy, crude oil type. While there are gas chromatograms of oil and saturated soil samples from this area, detailed descriptions of the type of oil that is represented by each chromatogram is not available.

12.6 Potential Sources of Free Oil

- Historical areas of potential sources of free oil at the A Hill Tank Field include ASTs, a former wax separator, and storm sewers (Geraghty & Miller, 1994). At the Main Building Area, potential sources of free oil include the ASTs, USTs, oil/water separators, process areas, sumps, and the sewers and septic systems (Geraghty & Miller, 1994).

12.6.1 Plume 13-AH

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plume (13-AH) on-site and the potential source areas identified at the A Hill Tank Field and the Main Building Area:

- In 1978, a 252,000-gallon spill of heating oil occurred at Tank 514 in the southern portion of the A Hill Tank Field. This spill was located in the upgradient portion of Plume 13-AH, and based on groundwater flow directions in this area, once the oil had encountered the water table it would have migrated to the northeast, which is consistent with the current configuration of the plume. In fact, the elongated central core of the thickest free oil in this plume aligns with Tank 514. In addition, a portion of the plume extends to the southwest, which is the opposite direction to the rest of the plume, and may be due to the groundwater divide in the area.

- In 1983, a 42,000-gallon spill of process gas oil occurred at Tank 508 in the western portion of the A Hill Tank Field. This spill did not occur within the footprint of Plume 13-AH and it is unlikely that the oil entered the sewer lines and was discharged near the plume due to the lack of cracks in the lines and the fact that the invert elevations of the lines are below the water table in this area.
- Two 2,000-gallon unleaded gasoline storage tanks (one of which was removed in 1989 and the other of which is currently in service) are located in areas where the free oil is the thickest. These tanks, or transfer lines associated with these tanks, may have contributed to the Plume 13-AH in this area, considering that the GC fingerprint of the sample from this area (AHFTMW5) contained minor gasoline range product, possibly automotive gasoline (Table 12-2).

12.6.2 Plume 13-ICI A, B, and C

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes [13-ICI A, B and C] and the potential source areas identified at the ICI site. Some of the information on the historical activities at the ICI site was obtained from aerial photographs taken in 1940, 1959, 1961, and 1963 (Malcolm Pirmie, 1998). The bullets are as follows:

- Petroleum above ground storage tanks were located in the eastern part of the current ICI property. At the time, Avenue J ended at East 22nd Street and this tank farm extended across what is now Avenue J onto what is currently IMTT property. At various times, this portion of the ICI property contained up to 14 above ground storage tanks. These tanks contained a number of different types of petroleum and petroleum-related products including slop oil, diesel, heating oil, gas oil, naphtha, and several varieties of crude oil (Malcolm Pirmie, 1998). These tanks were located in the area of Plumes 13-ICI A and B. The southern portion of this area extended as far as well MW3S, which is located in the ICI employee parking lot.
- Another area, called the New Jersey Sales Area, was located on the south-central and western portions of the ICI property. More specifically, it was located along East 22nd Street between Avenues H and I. This area was used for sales of petroleum and petroleum-related products that were manufactured by Exxon (Malcolm Pirmie, 1989). In addition to buildings, the area contained two large above ground storage tanks, nine small above ground storage tanks, and a rack area where tank trucks were loaded. This area also included four large above ground storage tanks. The six large tanks at one time contained heating oil, diesel oil, low sulfur #4 and gas oil. The nine smaller tanks were used to store materials that were sold at the New Jersey Sales area including kerosene, Esso Extra, Varsol, and naphtha. Well MW2S is located in the southern portion of the New Jersey Sales area. The New Jersey sales area was located in the southern portion of Plume 13-ICI A, on the ICI site.
- An Inter-Refinery Pipeline (IRPL) area and pumping station was located in the area to the north of the New Jersey Sales area. The pipeline was used to pump petroleum and petroleum-related products between the Exxon facilities in Bayonne and Bayway, New Jersey. The facility consisted of a pump house and manifold, and the pipeline that ran in a southwest direction off the current ICI property. According to Malcolm Pirmie (1998), the materials pumped through the line included gasoline, diesel fuel, unfinished middle distillate (gas oil), solvent oil, No. 2 and No. 4 fuel oil, alkylate, and naphtha. None of the plumes on the ICI site appear to correlate with the location of the IRPL area. The IRPL area appears to be northwest of Plume 13-ICI (A) and south of Plume 13-ICI (B).

- A waste disposal area existed in the northwestern portion of the ICI site. According to Exxon's 103 (c) Notification and Waste Disposal Site Inventory, a landfill or group of landfills for disposal of waste oils and petroleum refinery type waste was located close to the western boundary of the current ICI property in what was then known as the Packards Tankfield. According to Malcolm Pirnie (1998), open ponds or lagoons were used for the temporary storage and disposal of waste oils and other petroleum refinery type waste from the late 1950s to the mid-1960s. Based on aerial photographs dating from the 1959 to 1963, these open ponds or lagoons were present in the northwest portion of the ICI site. These open ponds or lagoons were located in the area of Plume 13-ICI (B).
- No spills are documented in the northern portion of the A Hill Tank Farm that could have contributed to a portion of Plume 13-ICI (A) on the Exxon site. Based on the measured apparent free oil thicknesses in the wells within the Plume 13-ICI (A) (which are thickest in off-site wells on the ICI property), and on the directions of groundwater flow, the most likely source for this plume is from releases at the off-site ICI property.
- The eastern portion of the site is currently occupied by the manufacturing facilities of ICI Americas. The operations at the ICI plant began in 1965 and consisted of manufacturing of chlorinated rubber products and paraffin wax products (from 1965-1980). Subsequent manufacturing on the site included vinylisocyanurate resins, isocyanate-based polymers, and polyesters (from 1969-1986), polyurethane (from 1969-1978), and polytetrafluoroethylene (from 1969-present). Various hazardous constituents are presently used in ICI's manufacturing operations including ammonia, hydrochloric acid, and non-chlorinated ignitable solvents. In addition, limited quantities of lubricating oils are used for lubricating gear boxes and compressors. Raw materials that were used in the past, but are no longer used, include styrene, carbon tetrachloride, trichloroethylene, toluene, chlorine, polyisoprene rubber, adipic and fumaric acids, G-1652 Int., neopentylglycol, hydroquinone, dimethylaniline, tertiarybutylcatechol, and chlorine and wax.

12.7 Free Oil Pump Testing Results

At Plume 13-AH, free oil pumping tests were performed at two wells GMMW28 and AHFMW1. At Plume 13-ICI (A), free oil pump tests were also performed at two wells (ICIMW2 and ICIMW3), which are in the central portion of the plume, and at one well (GMMW26) in the southern portion of the plume. At Plume 13-ICI (C), free oil pumping tests were performed at one well (MW9S) (Table 12-4). These are all non-tidal areas. The results of the tests are summarized below. The detailed results are contained in Appendix M.

Plume 13-AH

- At well GMMW28 (Plume 13-AH), which had a design apparent free oil thickness of 0.41 feet, free oil recovery could not be sustained for any of the three pumping test methods (Table 12-4). During the dual fluids pump test at TRHWMW1, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate of 0.03 gpm.
- At well AHFMW1 (Plume 13-AH), the vacuum enhanced pumping test yielded the highest sustainable free oil recovery rate (0.09 gpm), while the recovery rates were lower (between 0.03 and 0.04) for the skimmer and dual fluids pumping tests (Table 12-4). The radius of groundwater influence was greater than 50 feet for the dual fluids pumping test.

Plume 13-ICI A

- At well ICIMW3, the maximum initial oil recovery rate of 0.1 gpm was obtained during the total (dual) fluids pumping test (Table 12-4); this test maintained the ground water at approximately 16 feet below the ground surface. The radius of influence for the total (dual) fluids test was between 10 and 50 feet. The recovery rate was lower for the skimmer test (0.05 gpm).
- At well ICIMW2, the maximum initial oil recovery rate of 0.25 gpm was obtained during the skimming test (Table 12-4). No additional testing was performed because this rate was greater than 0.1 gpm that was set as the cut-off for the field scale testing.
- At well GMMW26 (Plume 13-ICI A, within A Hill Tank Field), the maximum sustained oil recovery rate of 0.03 gpm was obtained during the total dual fluids and vacuum enhanced pumping test (Table 12-4).

Plume 13-ICI B

- There are no pump testing results for Plume 13-ICI B. However, estimated oil recovery rates of 0.00006 gpm and 0.0044 were determined from a baildown tests at ICITMW8 and MW5S, respectively. The average recovery rate was 0.0022 gpm.

Plume 13-ICI C

- At well MW9S, a maximum initial oil recovery rate of 0.00007 gpm was obtained during the skimmer test. This skimming data was collected to provide a rough estimate of how easily oil could be recovered at this plume. Because of the high viscosity of the oil in this plume, additional testing was not proposed.

12.8 Description of Existing Free Oil Recovery System

There are no existing free oil recovery systems at the A Hill Tank Field are or the ICI site.

12.9 Conceptual Strategies for Free Oil Recovery Design

12.9.1 Plume 13-AH

- The pumping test results indicate that sustained free oil recovery rates are variable at Plume 13-AH. The test in the western portion of the plume indicated that the highest sustainable free oil recovery rate was 0.09 gpm using vacuum enhanced dual fluids pumping. This rate is slightly below the 0.1 gpm recovery rate that was defined in the FORP Workplan. The radius of groundwater influence during the testing was generally between 10 and 50 feet. The skimming and total fluids oil recovery rates were less than one half of the rate obtained with the vacuum enhanced method. In the western portion of the plume, no sustained oil could be recovered from the test well.
- Currently, there is no free oil recovery system that specifically addresses Plume 13-AH, although if left in place, most of the plume would eventually migrate to the Interceptor Trench, based on groundwater flow directions in the area.

- At Plume 13-AH, sustained oil recovery is not practicable based on the 0.1 gpm recovery rate criterion. However, conceptual methods for free oil recovery that will be evaluated even though the yields are less than 0.1 gpm include sustained pumping using either skimming, total dual fluids pumping and vacuum enhanced pumping. In addition, another alternative to recover oil from a portion of the plume near the Main Building would be to construct a collection trench/drain on the western and southern sides of the building. The collection system on the western and southern sides of the building would be downgradient of the majority of Plume 13-AH.
- At Plume 13-AH, the following additional information should be considered for the design of a free oil recovery system: 1) Access to this area may be a potential problem due to activity around the Main Building and the primary plant entrance (Scale-House); 2) Several areas in the A-Hill Tank Field were identified as areas of low, medium, and high density chromium contamination

12.9.2 Plume 13-ICI A

- On the ICI site, the pumping test results indicated that the maximum sustained free oil recovery rate was 0.25 gpm, which was achieved during the skimmer test in the south-central portion of the plume, within the employee parking lot at ICI. The radius of influence in the oil was determined to be between 5 and 10 feet during this test. In the central portion of the plume, the maximum sustained free oil recovery rate was 0.1 gpm, which was achieved during the total (dual) fluids pumping test using a ground water pumping rate of approximately 0.6 gpm. The radius of influence was between 10 feet and 50 feet for this test. The oil recovery rate using skimming in the central portion of the site was 0.05 gpm.
- On the Exxon site (south side of East 22nd Street), the pumping test results indicate that the maximum sustained free oil recovery rate was 0.03 gpm during the total dual fluids pumping and vacuum enhanced tests. During this test, the radius of groundwater influence was between 5 feet and 10 feet, using a groundwater pumping rate of between 0.05 and 0.07 gpm. The oil recovery rates for skimming and vacuum enhanced pumping were slightly less than for total fluids pumping. These rates were below the 0.1 gpm recovery rate that was defined as reasonable for the FORP.
- Currently, there is no free oil recovery system that addresses Plume 13-ICI A.
- In the central and northern portions of Plume 13-ICI A, on the ICI site, conceptual methods for free oil recovery include skimming and total (dual) fluids pumping. An interceptor trench could be used at selected site boundaries.
- In the southern portion of Plume 13-ICI A, within the A Hill Tank Field, conceptual methods for free oil recovery that will be evaluated, include sustained skimming and total fluids pumping from vertical wells; the testing indicated that vacuum enhanced pumping was not necessary to achieve reasonable oil recoveries in the locations tested.
- At Plume 13-ICI A, the following additional information should be considered for the design of a free oil recovery system: 1) There are numerous utilities on East 22nd Street and on the ICI property; and 2) Site access is limited by buildings in the operational portion of the site; and 3) Several areas in the A-Hill Tank Field were identified as areas of low, medium, and high density chromium contamination.

12.9.3 Plume 13-ICI B

- No pumping test results are available for this plume, however, the relatively high viscosity of the oil suggests that it would be difficult to remove using method that create drawdown of the water table (i.e., the oil will likely be held up in the formation above the water table). Intermittent skimming or vacuum enhanced pumping may be applicable at this plume. An interceptor trench could be used at the site boundary along Avenue J.
- Currently, there is no free oil recovery system that specifically addresses Plume 13-ICI B, however, across Avenue J, and downgradient from the plume, is the northwest extension of the interceptor trench, which is capturing oil at Plume 11.
- At Plume 13-ICI B, the following additional information should be considered for the design of a free oil recovery system: 1) This system may take into consideration the potential recovery of a portion of this plume by the interceptor trench, and 2) There are numerous utilities on Avenue J, which separates plumes 11 and 13-ICI B, and on the ICI property.

12.9.4 Plume 13-ICI C

- The skimming pumping test results indicated that the maximum sustained free oil recovery rate was 0.00007 gpm; these tests had to be conducted over a number of days because of the slow recovery to the well. The oil was highly viscous and adhered to/coated any piece of equipment that was placed into the well. The very high viscosity of this oil is the likely reason for such a low recovery rate. This rate was well below the 0.1 gpm recovery rate that was defined as the reasonable benchmark for the FORP. No total (dual) fluids or vacuum enhanced pumping were proposed at this plume.
- Currently, there is no free oil recovery system that addresses Plume 13-ICI C.
- In Plume 13-ICI-C, the conceptual methods for free oil recovery that will be evaluated include periodic skimming, even though yields are anticipated to be many order of magnitude less than 0.1 gpm, and containment.
- At Plume 13-ICI, the following additional information should be considered for the design of a free oil recovery system: 1) The plumes exists is an area where the former storage lagoons were located, 2) The fill that was used to fill in the lagoons consisted of cinders and construction debris. The construction debris (concrete slabs etc.) may hamper any subsurface excavating in the area of this plume.

Table 12-1

Baildown Testing Results for Plumes 13-AH and 13-ICI

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R- Raviv	Apparent Oil Thickness for Design (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 13-AH						
7/15/97	AHFTMW5	P	7.32	1.80	4.07	(not included in average)
7/16/97	AHFTMW5	P	7.32	1.45	5.05	
7/17/97	GMMW28	P	0.41	0.09	4.56	
7/21/97	AHFTMW1	P	3.14	0.38	8.26	
					5.96	Average Exaggeration Ratio

5	Applied Exaggeration Ratio
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Plume 13-ICI A						
7/17/97	GMMW26	P	1.79	0.39	4.58	
7/23/97	AHFTMW4R	P	0.58	0.13	4.58	
10/28/98	PZ-1	P	NA	NA	NA	(data not interpretable)
10/27/98	PZ-3	P	6.54	6.65	0.98	
10/26/98	PZ-6	P	NA	NA	NA	(data not interpretable)
11/4/98	ICIMW2	P	NA	NA	NA	(data not interpretable)
11/10/98	ICITMW2	P	4.07	2.29	1.78	
10/28/98	MW-2S	P	4.19	1.74	2.41	
11/4/98	MW-3S	P	NA	NA	NA	(data not interpretable)
10/26/98	MW-6S	P	3.96	1.77	2.24	
11/5/98	MW-10S	P	1.07	0.20	5.35	
10/27/98	MW-11S	P	2.02	0.97	2.08	
					3.00	Average Exaggeration Ratio

3	Applied Exaggeration Ratio
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Plume 13-ICI B

11/12/98	ICITMW8	P	3.25	0.14	23.21	Oil sticking to probe; ? result
10/27/98	MW-5S	P	3.14	0.31	10.13	Oil sticking to probe; ? result
High viscosity of oil resulted in oil sticking to probe during the test					16.67	Average Exaggeration Ratio

2	Applied Exaggeration Ratio
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Plume 13-ICI C

Not tests were performed due to the extremely high viscosity of the oil in the plume. This would have resulted in oil sticking to the probe, which would invalidate the testing results.

2	Applied Exaggeration Ratio
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Table 12-2

Free Oil and Soil Analysis Information for Plume 13-AH, and 13-ICI A and C

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well/Location I.D.	Source of Data	GC Fingerprint Summary Description	Field Sample Description	GRO (%)	DRO (%)	RRO (%)	Total VOCs - including TICs (ppb)	Total BTEX (ppb)	Viscosity (cS)	Specific Gravity
Plume 13-AH										
GMMW28	Parsons Fall 1997	Moderately to severely weathered heavy fuel oil product (e.g., fuel oil #5 or #6) or crude oil. Minor gasoline range product(s)	Non-Aqueous Phase Liquid	6	72	21	14,530,000	130,000	7.7	NA
AHFTMW-5	Parsons Fall 1997	Slightly weathered diesel fuel or fuel oil #2 mixed with moderately to severely weathered heavy fuel oil (#5 or #6) or crude oil; minor gasoline range product(s), possibly automotive gasoline	Non-Aqueous Phase Liquid	7	78	15	16,680,000	630,000	6.0	NA
AHFTMW-6	Parsons Fall 1997	Mixture of unspecific gasoline range product (perhaps gasoline), a moderately weathered diesel fuel or fuel oil #2, and/or a moderately to severely weathered heavy fuel oil (#5 or #6) or crude oil	Non-Aqueous Phase Liquid	12	75	13	NA	NA	3.2	NA
AHFTMW-8	Parsons Fall 1997	Severely weathered crude oil or a mixture of severely weathered diesel fuel #2 component with a heavier fuel oil (#5 or #6)	Non-Aqueous Phase Liquid	1	74	26	NA	NA	NA	NA
AHTFSB-4	Parsons Fall 1997	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	NA	NA	NA	NA	NA	NA	0.820
MBSB-2	Parsons Fall 1997	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	NA	NA	NA	NA	NA	NA	0.820
Plume 13- ICI A										
GMMW26	Parsons Fall 1997	Slightly weathered diesel fuel or fuel oil #2 mixed with moderately to severely weathered heavy fuel oil (#5 or #6) or crude oil; minor gasoline range product(s), possibly automotive gasoline	Non-Aqueous Phase Liquid	9	81	10	29,450,000	4,190,000	2.6	NA
AHTFSB-1	Parsons Fall 1997	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	NA	NA	NA	NA	NA	NA	0.820
PZ-1	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	26.9	63	10	NA	NA	NA	NA
PZ-2	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	28.6	63.2	8.2	NA	NA	NA	NA
PZ-3	Parsons Fall 1998	Mixture of: 1) a slightly weathered diesel/fuel oil #2, 2) a slightly to un-weathered light petroleum product (gasoline?), and 3) minor amount of moderately to severely weathered heavy fuel/crude oil.	Non-Aqueous Phase Liquid	22	72	6	66,212,000	8,312,000	1.8	NA
PZ-3	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	35.5	55.8	8.7	NA	NA	NA	NA

Table 12-2

Free Oil and Soil Analysis Information for Plume 13-AH, and 13-IC1 A and C

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well/Location I.D.	Source of Data	GC Fingerprint Summary Description	Field Sample Description	GRO (%)	DRO (%)	RRO (%)	Total VOCs - including TICs (ppb)	Total BTEX (ppb)	Viscosity (cS)	Specific Gravity
PZ-4	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	5.2	67	27.8	NA	NA	NA	NA
PZ-6	Parsons Fall 1998	Moderately to severely weathered heavy fuel oil product (e.g., fuel oil #5 or #6) or crude oil	Non-Aqueous Phase Liquid	4	77	19	8,968,800	88,800	8.7	NA
PZ-6	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	6.8	66.6	26.6	NA	NA	NA	NA
MW2S	Parsons Fall 1998	Severely weathered diesel/fuel oil #2 and a small amount of moderately to severely weathered heavy fuel/crude oil	Non-Aqueous Phase Liquid	5	85	10	19,294,400	104,400	5.4	NA
MW2S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	7.5	78.9	13.5	NA	NA	NA	NA
MW3S	Parsons Fall 1998	Mixture of: 1) a slightly weathered diesel/fuel oil #2, 2) a slightly to un-weathered light petroleum product (gasoline ?), and 3) minor amount of moderately to severely weathered heavy fuel/crude oil	Non-Aqueous Phase Liquid	16	77	8	7,135,000	47,135,000	2.4	NA
MW3S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	24.5	62.5	13	NA	NA	NA	NA
MW3S	Parsons Fall 1997	Coal-derived liquid (coal tar, creosote, wash oil, etc.)	Non-Aqueous Phase Liquid	3	86	11	NA	NA	NA	NA
MW5S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	6.4	62.3	31.3	NA	NA	NA	NA
MW6S	Parsons Fall 1998	Moderately to severely weathered heavy fuel oil product (e.g., fuel oil #5 or #6) or crude oil	Non-Aqueous Phase Liquid	1	89	10	NA	<62,000	5.3	NA
MW6S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	2.5	77.8	19.7	NA	NA	NA	NA
MW7S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	1.8	58	40.2	NA	NA	NA	NA
MW9S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	1.1	32.3	66.5	NA	NA	NA	NA
MW10S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	18.6	54.3	27.2	NA	NA	NA	NA
MW11S	Parsons Fall 1998	Mixture of: 1) a slightly weathered diesel/fuel oil #2, 2) a slightly to un-weathered light petroleum product (gasoline ?), and 3) minor amount of moderately to severely weathered heavy fuel/crude oil	Non-Aqueous Phase Liquid	29	64	7	90,368,000	9,980,000	1.6	NA

Table 12-2

Free Oil and Soil Analysis Information for Plume 13-AH, and 13-ICI A and C

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well/Location I.D.	Source of Data	GC Fingerprint Summary Description	Field Sample Description	GRO (%)	DRO (%)	RRO (%)	Total VOCs - including TICs (ppb)	Total BTEX (ppb)	Viscosity (cS)	Specific Gravity
MW11S	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	45	44.8	10.3	NA	NA	NA	NA
AT-7	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Non-Aqueous Phase Liquid	3	66.1	30.9	NA	NA	NA	NA
Plume 13-ICI C										
PTL-TP2	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Representative of entire coal ash thickness"	NA	NA	NA	NA	NA	NA	NA
PTL-TP3	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Thick tar-like substance"	NA	NA	NA	NA	NA	NA	NA
PTL-TP4A	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Coal ash"	NA	NA	NA	NA	NA	NA	NA
PTL-TP4B	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Coal ash containing debris"	NA	NA	NA	NA	NA	NA	NA
PTL-TP4C	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Coal ash saturated with petroleum"	NA	NA	NA	NA	NA	NA	NA
PTL-TP5	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Representative of entire coal ash thickness"	NA	NA	NA	NA	NA	NA	NA
PTL-TP6	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Clean silty clay"	NA	NA	NA	NA	NA	NA	NA
PTL-TP7	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Representative of entire coal ash thickness with petroleum"	NA	NA	NA	NA	NA	NA	NA
PTL-TP8	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Representative of entire coal ash thickness with petroleum"	NA	NA	NA	NA	NA	NA	NA
LL-1	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Representative of coal ash stained with petroleum"	NA	NA	NA	NA	NA	NA	NA
LL-2	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Representative of coal ash stained with petroleum"	NA	NA	NA	NA	NA	NA	NA
LL-3	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Clean silty clay"	NA	NA	NA	NA	NA	NA	NA
LL-4	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Silty clay saturated with petroleum from drum"	NA	NA	NA	NA	NA	NA	NA
LL-5	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Fine, black, uniform granular material"	NA	NA	NA	NA	NA	NA	NA
LL-6	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Tar seep on ground surface"	NA	NA	NA	NA	NA	NA	NA

Table 12-2

Free Oil and Soil Analysis Information for Plume 13-AH, and 13-ICI A and C

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well/Location I.D.	Source of Data	GC Fingerprint Summary Description	Field Sample Description	GRO (%)	DRO (%)	RRO (%)	Total VOCs - including TICs (ppb)	Total BTEX (ppb)	Viscosity (cS)	Specific Gravity
LL-7	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Clean silty sand/silty clay and fill"	NA	NA	NA	NA	NA	NA	NA
LL-10	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Whitish-gray to greenish paraffin like material"	NA	NA	NA	NA	NA	NA	NA
LL-11	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Coal ash where dark petroleum like fluid is flowing into pit"	NA	NA	NA	NA	NA	NA	NA
LL-12 S1	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Cleaner coal ash and thick, dark, fine to medium cohesive sandy material"	NA	NA	NA	NA	NA	NA	NA
LL-12 D1	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Coal ash saturated with petroleum"	NA	NA	NA	NA	NA	NA	NA
LL-12 S2	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Tar like sticky cinder filled material"	NA	NA	NA	NA	NA	NA	NA
LL-12 D2	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Coal ash with clay saturated with petroleum"	NA	NA	NA	NA	NA	NA	NA
LL-13	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Thick black product flowing into pit from all directions"	NA	NA	NA	NA	NA	NA	NA
LL-14A	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Solidified tar like material similar to asphalt"	NA	NA	NA	NA	NA	NA	NA
LL-14B	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Tar like material"	NA	NA	NA	NA	NA	NA	NA
LL-14C	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	"Unknown material, silty clay like texture, strong petroleum odor"	NA	NA	NA	NA	NA	NA	NA
LL-15	Malcolm Pirnie Spring 1998	No laboratory description available (see chromatogram)	Sample of Viscous product floating on the water surface"	NA	NA	NA	NA	NA	NA	NA

Notes

1) Data collected by Parsons.

GRO is defined as gasoline range organics with molecular range C8 to C10.

DRO is defined as diesel range organics with molecular range C10-C25.

RRO is defined as residual range organics with molecular range C25-C36.

2) Data collected by Malcolm Pirnie:

GRO is defined as gasoline range organics with molecular range <C10.5.

DRO is defined as diesel range organics with molecular range >C10.5-<C21.5.

RRO is defined as residual range organics with molecular range >C21.5.

Table 12-3

Soil Profile Data for Plume 13-AH and 13-ICI A

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil and Grease (%)	Moisture (%)	Porosity	Comments
AHFSB1-0	0.0 - 0.8	4.88	13.44	0.49	Plume 13-AH
AHFSB1-2	2.0 - 3.8	1.40	19.53	0.34	Plume 13-AH
AHFSB1-4	4.0 - 5.6	0.28	13.96	0.32	Plume 13-AH
AHFSB1-4*	4.0 - 5.6	0.43	NA	NA	Plume 13-AH
AHFSB1-6	6.0 - 7.6	0.47	11.8	0.26	Plume 13-AH
ICIMW1	5.0 - 6.6	0.02	17.92	0.33	Plume 13-ICI A
ICIMW2	15.0 - 17.0	NA	NA	NA	Plume 13-ICI A; Failed Shelby Tube
ICIMW3	5.0 - 7.0	NA	NA	NA	Plume 13-ICI A; Failed Shelby Tube

Notes:

(1) * = Duplicate

(2) NA = Not Available

(3) The depth to water in AHFSB1 was approximately 5 feet below the ground surface.

(4) The depth to water in ICIMW1 was approximately 12 feet below the ground surface.

(5) The depth to oil/water in ICIMW2 was approximately 15 feet below the ground surface.

(6) The depth to oil/water in ICIMW3 was approximately 8 feet below the ground surface.

Table 12-4

Pump Test Results for Plumes 13-A11 and 13-IC1

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well ID	NAPL Skimmer Tests				Total (dual) Fluids Pumping Tests								Vacuum Enhanced Total (dual) Fluids Pumping Tests									
	Date	S a u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S a u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)	Ground Water Pumping Rate (gpm) Q	Sustained Ground Water Drawdown (feet) s	Specific Capacity (gpm/ft of drawdown) Q/s	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)		
GMMW28 Plume 13-AH (Exxon site)	7/31/97	P	35	0.000	7/31/97	P	106	0.000	>10	<50	0.03	4.5	0.007	7/31/97	P	89	0.000	>10	<50	0.09	0.02	49
AHFMW-1 Plume 13-AH (Exxon site)	9/8/97	P	130	0.040	9/8/97 9/9/97	P (1)	70	0.030	>50	0.60	0.6	1.017	9/9/97	P	120	0.090	>10	<50	0.4	1.15	41	
GMMW26 Plume 13-ICI A (Exxon site)	7/25/97	P	107	0.020	7/25/97 7/25/97	P P	100 80	0.030 0.020	>5 >5	<10 <10	0.07 0.05	8.8 10.7	0.008 0.005	7/28/97	P	132	0.030	>5	<10	0.06	4.0	50
ICIMW1 Plume 13-ICI A (ICI site)	(no testing was performed because no oil entered the test well)				(no testing was performed because no oil entered the test well)								(no testing was performed because no oil entered the test well)									
ICIMW2 Plume 13-ICI A (ICI site)	10/29/98 10/30/98	P P	320 185	0.230 0.250	(not needed because the 0.1 gpm rate was achieved in the previous test)								(not needed because the 0.1 gpm rate was achieved in the previous test)									
ICIMW3 Plume 13-ICI A (ICI site)	11/2/98 11/4/98	P P	318 249	<0.08 0.050	11/3/98	P	135 200 90	0.100 0.070 0.060	>10 >10 >10	<50 <50 <50	0.06 0.10 0.12	0.3 3.3 5.3	0.2 0.03 0.02	(not needed because the 0.1 gpm rate was achieved in the previous test)								
MW9S Plume 13-ICI B (ICI site)	10/28/98 11/5/98	P P	3059 1845	0.00007 0.00006	(no further testing was proposed at this plume)								(no further testing was proposed at this plume)									

Note:

(1) Removal of oil from the well during dual fluids tests with greater groundwater drawdowns was hampered by the high viscosity of the oil and emulsification.

13.0 Plume 14 (Lube Oil Area)

13.1 Introduction

- Plume 14 exists in the Lube Oil Area (**Figure 13-1** and **Figure 13-2**).
- Currently, the Lube Oil Area consists of five tank fields. The fields are as follows: Finished Products, Lube Base Stock, Necton, Wax, and Former Bulk Wax Shipping Tanks. Within these five fields are approximately 236 above ground storage tanks (Geraghty & Miller, 1995). Approximately 200 of these tanks in the northern portion of the Lube Oil Area store various petroleum products, such as transmission fluid, lubricating oils, oil additives, and waxes. Also, in the southern portion of the area, two tanks near Pier 1 are used for 90-day hazardous waste oil storage, and four tanks are associated with the processes at the West Side Treatment Plant (Geraghty & Miller, 1995). The Lube Oil Area also includes a tank car transfer area, a tank truck loading and unloading area, and a blending and packaging warehouse. The operational history of this area includes different processes, which were in a more dense configuration than exists today.
- In 1940, the Lube Oil Area included several operational areas in a different and more dense configuration than exists today. These former areas included a refining area, a mixing and blending area, a wax production area, a bulk wax shipping tank field, the main office building, various shop buildings, a barrel factory, and refrigerating buildings (Geraghty & Miller, 1995).

13.2 Field Work

13.2.1 Free Oil Delineation Tasks

- Nine temporary wells were installed in the Lube Oil Area (LUBTMW1 through LUBTMW9) (2 more than specified in the FORP Workplan). NJDEP permits for the installation of these wells are included in Appendix N.
- Installed one permanent well (LUBMW1), as specified in the Work Plan.
- As required by the Workplan, performed 1 soil boring (LUBSB1) near existing wells GMMW1. Collected 3 soil samples (one less than specified in the Workplan) for analysis of FORP Workplan design parameters (% residual oil, % water, porosity, and bulk density). Also, one of these soil samples collected within the oil zone on the water table was analyzed for grain size.
- Measured the apparent thickness of oil in all existing and proposed wells in the Lube Oil Area in accordance with the Workplan. In total, 21 measuring events were taken.
- Performed free oil characterization on 5 samples (1 more than specified in the Workplan). The following analyses were performed: 1) GC fingerprinting: LUBTMW3, LUBTMW6, GMMW1, GMMW19, and EB17; 2) VOA: LUBTMW3, LUBTMW6, GMMW1, and GMMW19; 3) Viscosity: LUBTMW3, LUBTMW6, GMMW1, and GMMW19.

13.2.2 FORP Design Support Tasks

- As specified in the Workplan, performed 4 bail down tests in the Lube Oil Area (LUBTMW4, LUBTMW6, GMMW1, and GMMW19).

- Performed free oil recovery rate testing at 1 well (GMMW1), as specified in the Workplan.
- Prior to the test at GMMW1, installed three observation wells at 5, 10, and 50 foot intervals from the well (LUBTOW1 through 3), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping, and vacuum enhanced testing at well GMMW1.

13.3 Description of Hydrogeology

The hydrogeology of the Lube Oil Area is summarized in the following bulleted items:

- The subsurface materials generally consist of fill to a depth of approximately 15 feet below the ground surface. At the Lube Oil Area, the fill was composed of mostly fine sand with varying coarser sand and gravel components and artificial debris [i.e., brick chips, wood; cinders and concrete fragments were reported by Geraghty & Miller (1995)]. In the southern two thirds of the area, a silt layer (from 0.3 feet to at least 2 feet thick) was encountered within the fine sand fill and it generally thickens to the south. The silt layer was encountered between 8 feet and 10 feet below the ground surface in the FORP borings. In borings performed in the eastern portion of the area for a previous study, the silt layer was up to 4 feet thick (Geraghty & Miller, 1995).
- In the vicinity of where the thickest apparent free oil was measured at Plume 14, the subsurface material near the water table consisted of very fine sand, and fine sand with little silt and trace gravel (LUBTMW6 and 7).
- Grain size analysis of a soil sample collected near the water table (from 8.0 feet to 8.5 feet) in a boring performed adjacent to GMMW1 indicated that the subsurface material is fine-grained. Specifically, the sample contained approximately 24% silt and clay, 33% fine sand, and the remaining 43% was composed of coarser sand and gravel particles. The results of this analysis are generally consistent with the soil description from Plume 14 given above.
- An unconfined groundwater zone is present in the fill on-site, and groundwater in the Lube Oil Area is generally between 5 feet and 6 feet below the ground surface.
- The groundwater flow direction is predominantly to the south (**Figure 3-1**). However, it is noteworthy that a groundwater mound exists in the south-central portion of the area; the mound may be caused by perching of the water table above the silt layer that exists in the southern portion of the area. This mound directs groundwater flow away from the central part of the Lube Oil Area to the west toward the Platty Kill Canal and to the east toward the eastern part of the Lube Oil Area. The hydraulic gradient in the northern portion of this area is 0.003.
- The unconfined groundwater zone is not influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides.

13.4 Free Oil Delineation Results

13.4.1 Apparent Free Oil Thickness

- Plume 14 is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 13-1**). A total of 27 wells were used for the delineation. The horizontal extent of the Plume 14 has been confirmed, and no further delineation is required.

- Plume 14 is an elongate plume that trends in a north-south direction within the Lube Oil Area. The north-south elongation of the plume is consistent with the general southern direction of groundwater flow. The maximum free oil thickness was 6.63 feet at LUBTMW6 in the extreme northern portion of the plume. Most of the apparent thickness plume is characterized by less than 1 foot of oil.
- The horizontal extent of the apparent free oil thickness in Plume 14 is generally the same as how it was depicted in the Geraghty & Miller (1995) report, however, the free oil apparent thickness in the northern portion of the plume is significantly greater than shown by Geraghty & Miller (1995) (Figure 13-1).

13.4.2 True Free Oil Thickness

- The true free oil thickness at Plume 14 is comprised of two free oil areas with thicknesses greater than 0.1 feet, one at the north end of the plume and another at the southern end (Figure 13-2). The maximum true free oil thickness was 1.11 feet at LUBTMW6.
- An exaggeration ratio of 6 was used for Plume 14.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 14 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996); 3 baildown tests completed at the Lube Oil Area (Table 13-1). The subsurface material near the water table consisted of very fine sand, and fine sand with little silt and trace gravel. We interpret these descriptions to correspond to a soil type between a sandy loam and loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for a soil of this type has a range of between approximately 2 and 6. In addition, the exaggeration ratios from three baildown tests showed a large range of values, from 3.20 to 11.05; the average exaggeration ratio was calculated to be 8.04. The average exaggeration ratio derived using the baildown tests is slightly greater than expected considering the grain size descriptions. Therefore, given the available data, an exaggeration ratio of 6 was used for Plume 14. The apparent free oil thickness and true free oil thickness data and graphs for this plume are contained in Appendix N.

13.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 14 and are included on Table 13-2.

- Generally, the GC fingerprint data show that the free oil from the northern, central and southern ends of Plume 14 are generally different.
- At the northern end of the plume, the sample from LUBTMW6 was shown to be comprised of a moderately weathered crude oil admixed with a gasoline range product(s) (and possibly a minor lube oil/asphalt product).
- In the central portion of the plume, the samples from LUBTMW3 and GMMW1 each contained very different oils. The sample from LUBTMW3 was comprised of gasoline and diesel range product(s) while the sample from GMMW1 was comprised of a mixture of diesel fuel oil #1 with a lube oil or severely weathered crude oil.
- Further south within Plume 14, oil from well GMMW19 contained mixtures of gasoline range and diesel range products, which were similar to that found at LUBTMW3 in the central portion of the plume.

- At the southern end of Plume 14, the oil from EB17 was comprised of a severely weathered diesel fuel/fuel oil #2, which was distinct from the sample at nearby GMMW19.
- The variability of the VOC data for the free oil samples provides additional support for a release of various products in this area (Table 13-2).
- The specific gravity of the free oil collected from two wells installed during a previous study (EB17 and EB24) were 0.918 and 0.895.
- Analyses of soil profile samples from a soil boring approximately 5 feet from well GMMW1, which had 0.55 feet of free oil (apparent) during the FORP, showed that the percent of oil and grease in the soil samples decreases with depth above the water table (Table 13-3). The proximity of free oil sources to this location is not clear from this profile. The laboratory data for percent oil is contained in Appendix N.

13.6 Potential Sources of Free Oil

Historical areas of potential sources of free oil at the Lube Oil Area include above ground storage tanks, underground storage tanks, oil/water separators, drum storage areas, loading and unloading areas, West Side Treatment Plant, and sewers and septic systems (Geraghty & Miller, 1994).

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the Lube Oil Area:

- Although there are numerous documented spills of oil within the Lube Oil Area, none of the spills occurred in the northern portion of the Plume, where the thickest apparent free oil was measured. Also, there were no documented spills that occurred within the rest of the footprint of Plume 14.
- A tank truck loading and unloading area was located over the area where the thickest apparent free oil was measured (6.63 feet in well LUBTMW6). While the geographic location of this truck loading/unloading area suggests that it may be a potential source, there are no documented spills in this area.
- A former gasoline underground storage tank was located in the central portion of Plume 14, near LUBTMW3, where unspecified gasoline products were found. However, the GC fingerprint results indicate that they are probably not gasoline.
- There are two cracks in Main Sewer Line #1 in the northern portion of Plume 14 (north of MH1-7 and near LUBTMW6), however, the invert elevations of this line is below the water table, according to sewer inspections, suggesting that it is not an area where oil may have been potentially discharged.
- A zone of densely spaced cracks in the sewer lines was documented between MH1-11 and MH1-16, which overlaps with the southern portion of Plume 14, however, as is the case for most of Main Line #1, the invert elevations of these lines are below the water table, making them unlikely sources for a release of oil.

13.7 Free Oil Pump Testing Results

Free oil pump tests were performed at well GMMW1 in the southern portion of Plume 14 (Table 13-4), which is a non-tidal area. The results of the tests are summarized below. The detailed results are contained in Appendix N.

- At well GMMW1, the maximum sustained oil recovery rate of 0.04 gpm to 0.05 gpm was obtained during both the total dual fluids pumping test and the vacuum enhanced test; the low-end recovery rate for these tests was 0.04 gpm (Table 13-4). The sustained oil recovery rates for the skimmer test was an order of magnitude less than for the other tests. During the dual fluids pump test at this well, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate of between 2.35 gpm and 2.44 gpm.

13.8 Description of Existing Free Oil Recovery System

There is no existing free oil recovery system at the Lube Oil Area.

13.9 Conceptual Strategies for Free Oil Recovery Design

- The pumping test results at well GMMW1 showed that the sustained oil recovery rate was 0.05 gpm during the total dual fluids pumping test and it was 0.04 gpm for the vacuum enhanced test. During the dual fluids pump test at this well, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate of just over 2 gpm.
- At Plume 14, sustained free oil recovery is not practicable at this time, based on the 0.1 gpm oil recovery criterion. However, conceptual remedial methods for oil recovery to be evaluated even though the yields are anticipated to be less than 0.1 gpm include total dual fluids pumping or vacuum enhanced pumping, both of which produced approximately the same recovery rate.
- At Plume 14, the following additional information should be considered for the design of a free oil recovery system: 1) There are access considerations due to highly trafficked areas, including roadways and loading docks; 2) The western and southern margins of the plume are in active tank and railroad areas where daily operations would be in conflict with construction efforts; 3) Numerous overhead and buried pipe systems (water, electric, and tank) exist at the south end of the plume; 4) There is an oil pipeline along the northern edge of the plume (i.e., along the railroad); and 5) The area at the north side of the Lube building was identified as an area of high density chromium contamination.

Table 13-1

Baildown Testing Results for Plume 14

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	Actual Product Thickness in Formation (feet)	Multiplier - Based on Design Data	Comments
7/15/97	LUBTMW6	P	6.63	0.60	11.05	
8/4/97	GMMW1	P	0.64	0.20	3.20	
7/30/97	GMMW19	P	0.03	0.00	9.86	Not Included in average; data questionable
7/30/97	LUBTMW4	P	1.07	0.11	9.86	

8.04 Average Exaggeration Ratio

6	Applied Exaggeration Ratio
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Table 13-2

Free Oil Analysis Information for Plume 14

Free Oil Recovery Project

Exxon Company, USA

Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
GMMW1	Mixture of moderately weathered diesel fuel oil #1 with a lube oil or severely weathered crude oil	7	58	35	2,936,000	0	7.4	NA
GMMW19	Mixture of slightly weathered diesel range product (probably diesel fuel or fuel oil #2) and an unspecified gasoline range product(s), probably not gasoline	21	74	5	16,365,000	15,000	2.0	NA
LUBTMW3	Mixture of a moderately weathered diesel range product (probably diesel fuel or fuel oil #2) and an unspecified gasoline range product(s), probably not gasoline	14	84	2	36,630,000	0	4.3	NA
LUBTMW6	Moderately weathered crude oil which is mixed with a less weathered, yet unspecified gasoline range product(s)	6	64	30	8,630,000	0	8.0	NA
EB17	Severely weathered diesel fuel #2 or fuel oil #2	1	93	6	NA	NA	6.9	0.918
EB24	NA	NA	NA	NA	NA	NA	NA	0.895

Note:

NA=Not Available

Table 13-3

Soil Profile data for Plume 14

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil and Grease (%)	Moisture (%)	Porosity
LUBSB1-2	2.0 - 2.7	2.04	16.30	0.59
LUBSB1-4	4.0 - 4.4	0.27	NA	N/A
LUBSB1-8	8.0 - 8.5	1.72	28.34	0.52

Notes:

(1) NA = Not Available

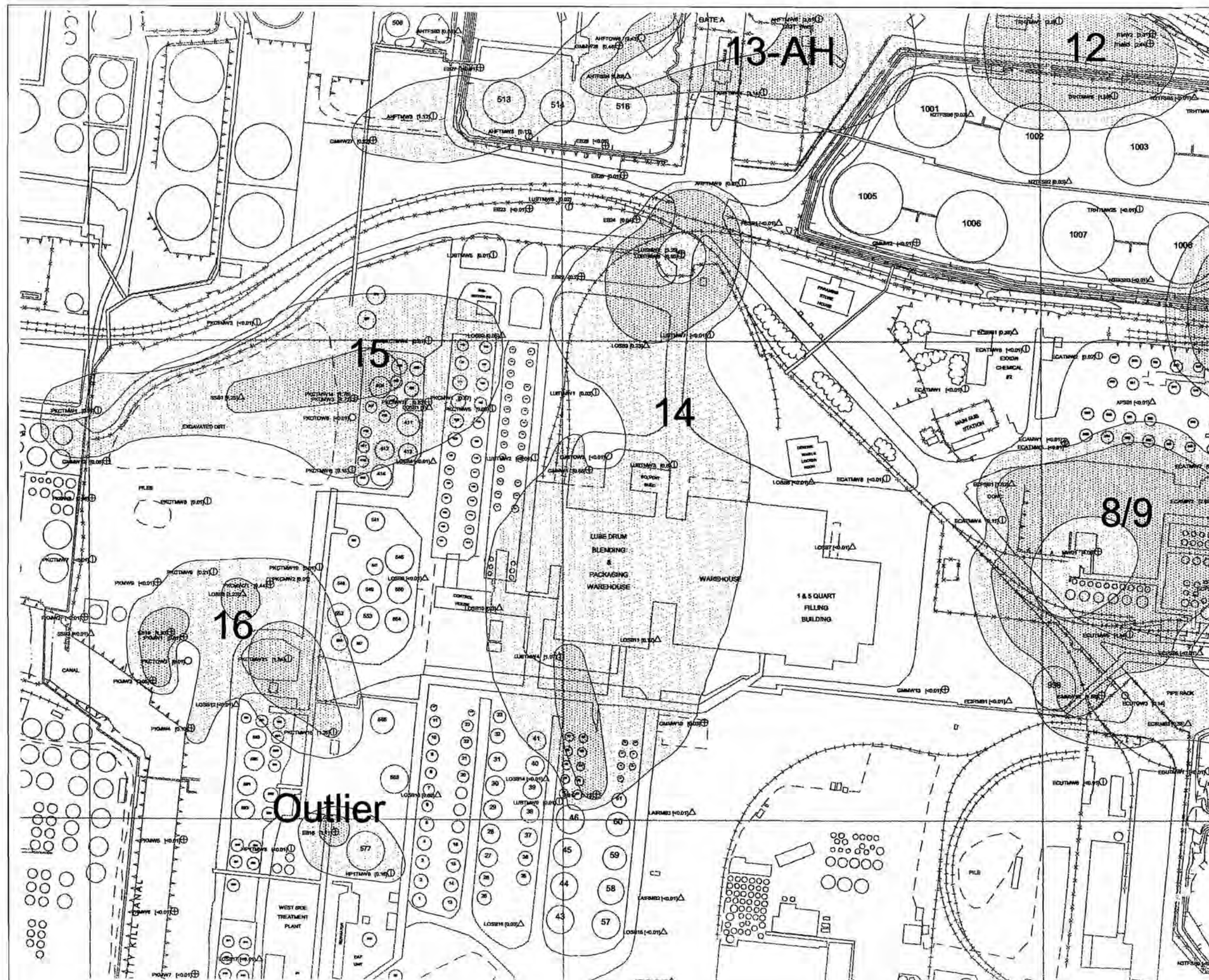
(2) The depth to water in LUBSB1 was approximately 6 feet below the ground surface.

Table 13-4

Pumping Test Results for Plume 14

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well ID	NAPL Skimmer Tests				Total (dual) Fluids Pumping Tests								Vacuum Enhanced Total (dual) Fluids Pumping Tests									
	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)		Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Specific Capacity (gpm/ft of drawdown)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)		Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)
											Q	s	Q/s									
GMMWI	8/8/97	P	76	0.004	8/8/97	P	60	0.05	>10	<50	2.35	2.2	1.083	8/11/97	P	295	0.040	>10	<50	7.5	2.6	50
					8/8/97		67	0.04	>10	<50	2.44	3.7	0.665									



LEGEND

- ⊕ Permanent Monitoring Well
- ⊖ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)

EB62 [0.92] Monitoring Well I.D. with Apparent Oil Thickness

Water Line

- 0.1 - 1 FT NAPL
- 1 - 4 FT NAPL
- >4 FT NAPL

100 0 100 200 300 400 Feet

1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK



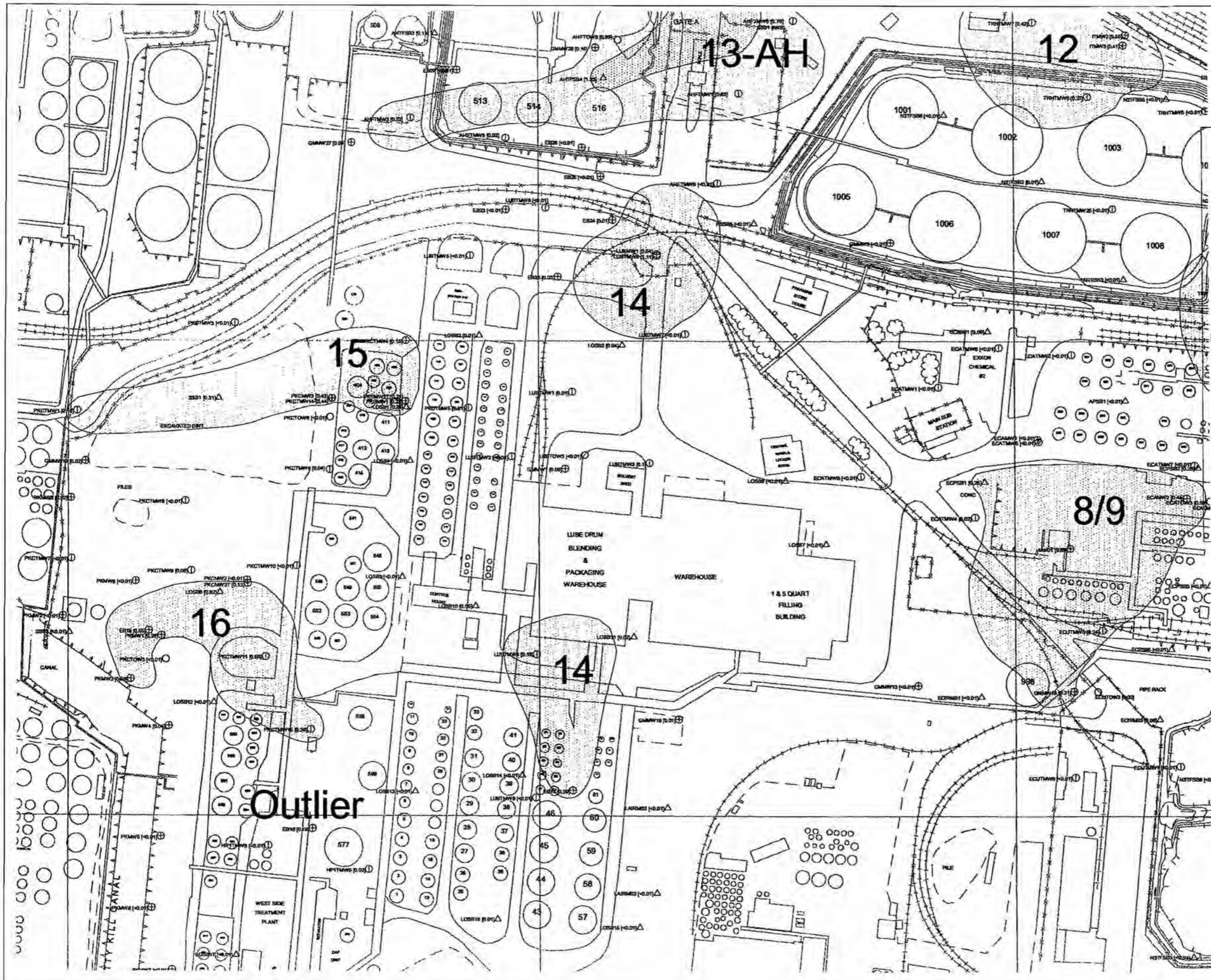
PARSONS ENGINEERING SCIENCE, INC.



COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

Environmental Engineering

Figure 13-1
Apparent Free Oil Thickness at
Plume 14



LEGEND

- ⊕ Permanent Monitoring Well
- ⓪ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)
- EB62 [0.92] Monitoring Well I.D. with True Oil Thickness
- Water Line
- 0.1 - 1 FT NAPL
- 1 - 4 FT NAPL
- >4 FT NAPL

100 0 100 200 300 400 Feet

1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

EXON COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

Environmental Engineering

Figure 13-2
True Free Oil Thickness at
Plume 14

14.0 Plumes 15, 16 and 16a (Platty Kill Canal Area)

14.1 Introduction

- Plumes 15, 16, and 16a exist in the Platty Kill Area (**Figure 14-1** through **Figure 14-5**).
- Currently, the Platty Kill Canal Area (Stockpile Area) is located at the western boundary of the Bayonne Plant. It currently consists of a vacant, unpaved lot used for temporary storage of scrap metal and other construction debris from former structures and buildings (Geraghty & Miller, 1994). Prior to the mid 1970s, the area contained a Wax Plant Building, a Phenol Lube Oil Treating Plant, and a MEK Dewaxing Plant, all of which were integral parts of wax production and lube oil manufacturing.

14.2 Field Work

14.2.1 Free Oil Delineation Tasks

- Nine temporary wells were installed at Plume 15 (PKCTMW1 through PKCTMW8, and PKCTMW14) (1 more than specified in the Workplan). NJDEP permits for the installation of these wells are included in Appendix O.
- Four temporary wells were installed at Plume 16 (PKCTMW9 through PKCTMW11, and PKCTMW15) (1 more than specified in the Workplan). NJDEP permits for the installation of these wells are included in Appendix O.
- One temporary well was installed at Plume 16a (PKCTMW13). Also, two additional wells at Plume 16 (which were initially intended as temporary) were retained as permanent wells (PKCTMW12 and PKCTMW16). In the end, 1 additional well beyond that originally proposed in the FORP Workplan was installed at Plume 16a. NJDEP permits for the installation of these wells are included in Appendix O.
- Installed two permanent wells at Plume 15 (PKCMW1 and PKCMW3) (1 more than required by the Workplan). Prior to the installation of permanent well PKCMW1, a temporary well was installed at the same location (PKCMW1T).
- As required by the Workplan, installed one permanent well at Plume 16 (PKCMW2). Prior to the installation of permanent well PKCMW2, a temporary well was installed at the same location (PKCMW2T).
- As required by the Workplan, performed 2 soil borings (PKCMW1T and PKCMW2T) and collected soil samples. Collected 3 vadose zone soil samples from each boring for a total of 6 samples (2 less than specified in the Workplan due to the short length of the vadose zone at each location). Submitted these samples for analysis of FORP Workplan design parameters (% residual oil, % water, porosity, and bulk density). Also, at each boring, one soil sample was collected within the oil zone at the water table for grain size analysis, as specified in the Workplan.
- Measured the apparent thickness of oil in all existing and proposed wells in the Platty Kill Canal Area in accordance with the Workplan. In total, 23 measuring events were taken at Plumes 15/16/16a.

- Performed free oil characterization on 6 samples (2 more than specified in the Workplan). The following analyses were performed: 1) GC fingerprinting: PKCTMW14, GMMW12, PKMW1, PKCTMW15, PKMW11, and PKCTMW12; 2) VOA: PKCTMW14, PKMW1, PKMW11, and PKCTMW12 ; 3) Viscosity: PKCTMW14, GMMW12, PKMW1, PKCTMW15, PKMW11, and PKCTMW12.

14.2.2 FORP Design Support Tasks

- Performed 3 baildown tests on unconfined wells in the Platty Kill Canal Area (PKCTMW1, PKCTMW14, PKMW1); one of the proposed wells (EB19) already had baildown test data from Raviv (1995) and, therefore, no test was done at this well. Also, two baildown tests were performed on wells screened in the confined groundwater zone (PKMW11 and PKCTMW12) (the Workplan called for 1 test to be performed in this lower zone).
- Performed free oil recovery rate testing at 2 wells (PKCMW3 - Plume 15, and PKMW1 - Plume 16), the same number as specified in the Workplan.
- Prior to the test at PKCMW3, installed three observation wells at 5, 10, and 50 foot intervals from the well (PKCTOW1 through 3), as required by the Workplan. Performed free oil skimming, total dual fluids pumping and vacuum enhanced testing at well PKCMW3, the same number of tests specified in the Workplan.
- Prior to the test at PKMW1, installed three observation wells at 5, 10 and 50 foot intervals from the well (PKCTOW4 through 6), as required by the Workplan. Performed total dual fluids pumping and vacuum enhanced pumping tests at well PKMW1, as indicated in the Workplan.

14.3 Description of Hydrogeology

The hydrogeology of the Platty Kill Canal Area is summarized in the following bulleted items:

- The subsurface materials at the Platty Kill Canal Area generally consist of fill to depths of approximately 10 to 13 feet below the ground surface. The fill is generally composed of fine to medium sand, with slag, cinders, wood, brick and coal material; there are portions of the fill area composed of very fine sand or silt based on the FORP borings. A peat/silt layer is present below the fill. The borings performed for the FORP confirmed the presence of the peat/silt layer (between 1.4 feet and 7 feet thick) in the central and eastern portions of the Platty Kill Canal Area; Raviv (1995) reported that this layer is up to 8 feet thick in some locations. The peat/silt layer overlies a zone of fine sand with interbedded gravel layers, which was also reported by Raviv (1995).
- At Plume 15, in the vicinity of where the thickest apparent free oil was measured (PKCTMW14), the subsurface material near the water table consisted of fine to coarse sand, little fine gravel, trace silt with varying amounts of brick and wood fragments.
- At Plume 16, in the vicinity of where the thickest apparent free oil was measured, the subsurface material near the water table consisted of fine to coarse sand, little gravel, trace silt with varying amounts of brick and wood fragments.
- At Plume 16a (which is in the confined groundwater zone), in the vicinity where the thickest apparent free oil was measured, the subsurface material below the base of the peat/silt layer consisted of fine sand with some silt, but in some locations these sands were interbedded with fine gravel.

- At Plume 15, grain size analysis of a soil sample collected near the water table (from 6.0 feet to 7.2 feet) in a boring (PKCMW1T) indicated that the subsurface material contained approximately 16% silt and clay, 33% fine sand, and the remaining 51% was composed of coarser sand and gravel particles.
- At Plume 16, the grain size analysis from boring PKCMW2T (from 4.0 feet to 5.2 feet) indicated that the subsurface material contained approximately 7% silt and clay, 41% fine sand, and the remaining 52% was composed of coarser sand and gravel particles. The results of these analyses are consistent with the soil descriptions for the interval near the water table given above.
- Free oil is present in both the unconfined groundwater zone and the confined groundwater zone at the Platty Kill Canal Area. The groundwater at Plumes 15 and 16 in the Platty Kill Canal Area is generally between 2 feet and 5 feet below the ground surface, which is within the fill. Plume 16a occurs within the sand and interbedded gravel zone below the peat/clay layer. The peat/silt layer is relatively impermeable and forms a horizontally extensive confining layer which limits vertical groundwater flow and potential free oil migration between the fill and the underlying soils (Raviv, 1995).
- The groundwater flow direction in the unconfined groundwater zone at Plume 15 is to the southeast based on the mid-tide groundwater contour map, and the hydraulic gradient across this plume is 0.011 (**Figure 3-1**).
- At Plume 16, the direction of flow in the unconfined zone is to the south and southwest toward Platty Kill Canal; the gradient at this plume is 0.018 (**Figure 3-1**).
- In the confined groundwater zone at Plume 16a, the groundwater flow direction is generally to the southwest toward Platty Kill Canal, and the hydraulic gradient is 0.002 (**Figure 3-1**). A reversal of groundwater gradient exists at high tide between the Platty Kill Canal (at the tidal gauging station) and well PKMW13 due to the lag of the tidal effect in the formation. Raviv (1994) also reported that a gradient reversal in wells PKMW12 and PKMW13 existed at high tide. There is no reversal of gradient based on average tidal elevations in these wells and the Platty Kill Canal tidal gauging station.
- The unconfined groundwater zone is influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides. The tidal influence (of greater than 0.1 feet change) affected only three wells that exist along the bend in Platty Kill Canal. The maximum tidal variation in these wells was 2.10 feet. The tidal influence extended approximately 75 feet inland.
- In the confined zone the piezometric head of groundwater was also affected by the tides. In the confined groundwater zone the magnitude of the maximum tidal variation (1.09 feet) was less in the unconfined zone, but the extent of inland influence was noticeably greater. A change of more than 0.1 foot was detected up to 250 feet inland.

14.4 Free Oil Delineation Results

14.4.1 Plume 15

Apparent Free Oil Thickness

- Plume 15 is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 14-1**). A total of 17 wells were used to delineate the plume. The horizontal extent of the Plume 15 has been confirmed, and no further delineation is required.
- Plume 15 is an elongate plume that occurs in the northern portion of the Platty Kill Canal Area, near a large stockpile of soil and construction debris, and it extends into the northwestern portion of the Lube Oil Area. It is generally elongated parallel to the direction of groundwater flow in this area. The maximum apparent free oil thickness was 1.75 feet at PKCTMW14 (**Figure 14-1**).

True Free Oil Thickness

- Plume 15, based on true free oil thickness, is comprised of a long, thin area of free oil that is greater than 0.1 feet thick (**Figure 14-2**). The maximum true free oil thickness was 0.44 feet at PKCTMW14.
- An exaggeration ratio of 4 was used for Plume 15.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 15 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 2 baildown tests completed at the Plume 15 (**Table 14-1**). The subsurface material near the water table consisted of fine to coarse sand, little fine gravel, trace silt with varying amounts of brick and wood fragments. These descriptions correspond to a soil type of between sand and sandy loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for soil of these types has a range of between 1.5 and 4. In addition, the exaggeration ratios from 2 baildown tests were 11.80 to 12.14, and the average ratio was 11.97. This average exaggeration ratio is greater than it was expected to be considering the grain size descriptions, and in order to develop a conservative ratio, less weight was given to the baildown testing results compared to the other data. Therefore, given the available data, an exaggeration ratio of 4 was used for Plume 15. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix O**.

14.4.2 Plume 16

Apparent Free Oil Thickness

- Plume 16 is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 14-3**). A total of 22 wells were used to delineate the plume. The horizontal extent of the Plume 16 has been confirmed, and no further delineation is required.
- Plume 16 is an irregularly shaped plume that exists in the central portion of the Platty Kill Canal Area. The plume is generally the same shape as shown in the FORP Workplan, except that it now extends farther to the southeast based on new wells installed in this area. The maximum apparent free oil thickness was 3.23 feet in an old temporary well (LOS8). The maximum thickness in an existing well (EB19) was 1.93 feet (**Figure 14-3**).

True Free Oil Thickness

- Plume 16, based on true free oil thickness, is a horseshoe-shaped area of free oil that is greater than 0.1 feet (**Figure 14-4**). The maximum true free oil thickness was 0.92 feet at LOSB8.
- An exaggeration ratio of 3.5 was used for Plume 16.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 16 was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 2 baildown tests completed at the Plume 16 (**Table 14-1**). The subsurface material near the water table consisted of fine to coarse sand, little gravel, trace silt with varying amounts of brick and wood fragments. We interpret these descriptions to correspond to a soil type of between sand and sandy loam using the soil types given on the exaggeration ratio chart cited in EPA (1996). According to EPA (1996), the ratio of apparent to true free oil thickness for soil of these types has a range of between approximately 2 and 4. In addition, the exaggeration ratios from 2 baildown tests were 3.03 and 3.94, and the average ratio was about 3.5. This exaggeration ratio is in line with what would be expected based on the grain size descriptions. Therefore, given the available data, an exaggeration ratio of 3.5 was used for Plume 16. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix O**.

14.4.3 Plume 16a

Apparent Free Oil Thickness

- Plume 16a is defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 14-5**). A total of 9 wells were used to delineate the plume. The horizontal extent of the Plume 16a has been confirmed, and no further delineation is required.
- Plume 16a is an irregularly shaped plume that exists in the central portion of the Platty Kill Canal (Stockpile) Area immediately east of the Canal. The plume is generally the same shape that was shown in the Workplan, except that it now extends farther to the northeast, because of additional wells installed in this area for the FORP. The maximum free oil apparent thickness (10.09 feet) was measured in PKMW11 in the south-central (downgradient) portion of the plume (**Figure 14-5**).

True Free Oil Thickness

- The true free oil thickness could not be determined in the confined groundwater zone tests using the same principles applied to the unconfined groundwater zone. This is because the oil present in the confined groundwater zone below the peat/silt layer has a tendency (i.e., preference) to flow into (and rise within) the monitoring wells because it is less dense than water and because of the surrounding hydrostatic pressure in the formation. Thus, the oil will accumulate within the well over time. This is unlike the unconfined groundwater zone where the amount of exaggeration in the well is based on grain size and capillary forces acting on the oil, as well as other factors.
- The thickness of oil in the sandy formation below the peat/silt layer is likely to be greater where the bottom of the peat/silt layer domes (or is at higher elevation than surrounding areas) because the oil would tend to migrate naturally to these areas.
- Also, a free oil recharge test in the confined well PKMW11, which had the greatest apparent thickness of oil (10.09 feet) for the FORP, indicated that the oil recharge rate was between 0.005 and 0.02 gpm (Raviv, 1995).

14.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plumes 15, 16, and 16a are included on **Table 14-2**. This table includes free oil characterizations from previous studies performed at the Platty Kill Canal Area.

- The oil samples from Plume 15 (GMMW12 and PKCTMW14) were clearly distinct from one another. This argues that Plume 15 has multiple sources of oil and it may be discontinuous (or at least heterogeneous). Recovery of free oil in this area will need to consider the heavy character of the oil, which would limit the mobility of the oil in the subsurface.
- At Plume 16, the two samples collected from wells PKMW1 and PKCTMW15 are chemically distinct, which argues for multiple sources of oil and potentially, discontinuous oil within the plume. As a note, the sample from PKMW1, a mid-range lube oil, was virtually identical to that observed in well PKCTMW14 in Plume 15.
- At Plume 16a, in the confined groundwater zone, the oil samples from wells PKMW11 and PKCTMW12 were also chemically distinct.
- The free oil collected from wells at Plumes 15, 16, and 16a had the following specific gravity values, respectively: 0.916 - 0.929; 0.917; and 0.883 - 0.911 (**Table 14-2**).
- At PKCMW1T, soil profile results showed that the percent of oil and grease in the vadose zone decreases with depth (**Table 14-3**). At PKCMW2T, the opposite trend is observed; the percentage of oil increases with depth to the water table. The laboratory soil profile data is contained in **Appendix O**.
- In addition, at Plume 16a, data collected from Raviv (1995) indicated that "evidence of [oil] was noted in soils taken from just below the silt and clay layer" and that the "average thickness of confined zone soils in which discontinuous layers of petroleum impacted sand and gravel were observed is about 3 feet." This provides additional evidence that the true thickness of oil in the confined groundwater zone is significantly less than the thicknesses measured in the confined zone wells (up to approximately 10 feet).

14.6 Potential Sources of Free Oil

Historical areas of potential sources of free oil at the Platty Kill Canal (Stockpile) Area include above ground storage tanks, oil/water separators, and process units (Geraghty & Miller, 1994).

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the Platty Kill Canal Area:

- At Plume 15, there are no documented spills of oil (Geraghty & Miller, 1994) that are likely sources of the plume based on proximity to the plume. In the Platty Kill Canal (Stockpile) Area, the only process related activity in this area was the Phenol Lube Oil Treating Plant (1934 - 1951) and tanks (1932 - 1963). These process areas were located within the eastern portion of Plume 15. Several operations were located within the footprint of Plume 15 where it overlaps the northwestern portion of the Lube Oil Area; these included a filter press building (1921 - 1951), tanks (1921 - 1940) and

press plate building (1932 - 1951). In addition, no sewer lines are likely to have contributed oil to the plume, based on maps of sewer pipeline breaks and invert elevations.

- At Plume 16, there are no documented spills of oil (Geraghty & Miller, 1994) that are likely sources of the plume. Two former oil/water separators were located in the area where one of the greatest apparent thicknesses was measured (near EB19), and based on this geographic association, it is a potential source of oil. In addition, a portion of the sewer line Lateral 1K between MH1K-4 and MH1K-5 has a break in the bottom of the line that is suspected to be approximately 30 feet long based on sewer surveys; this location coincides with the greatest apparent thickness of oil in the eastern portion of Plume 16 (near PKCTMW15). However, the pipe is partially submerged and while it is a possible source of free oil, it appears an unlikely primary source.
- At Plume 16a, the mechanism by which oil migrated beneath the peat/silt layer is not known, so it is difficult to speculate as to the potential sources of the oil. However, because Plumes 16 and 16a overlap somewhat, the same sources listed above for Plume 16, also apply to Plume 16a. Plume 16a extends farther northeast than Plume 16 and, thus, additional sources include three oil/water separators and a release of 250 gallons of slop oil from Tank 545 in the Lube Oil Area. Because the oil at Plume 16a occurs beneath the peat/silt layer in the Platty Kill Canal Area, it is uncertain how the oil was discharged (and migrated) to this location. The peat/silt ("clay") layer covers much of the Platty Kill Canal area and some of the western portion of the Lube Oil Area, and it is from 1 foot to 6 feet thick based on borings completed in the area.
- According to studies performed by Raviv (1994) at the Platty Kill Canal Area, it was determined that there was no migration of oil from the unconfined groundwater zone to the Canal. Some of the evidence that Raviv (1994) used to support this was the lack of significant oil the wells next to the Canal (with the exception of PKMW3 which had a maximum apparent thickness of 0.24 feet) and the physical barrier created by the two vertical bulkheads along the edge of the Canal. Generally, the FORP results do not dispute any of these findings, but the FORP results do indicate that the oil has become thicker in wells near the Canal since the Raviv (1994) investigation. Specifically, the apparent oil thickness in PKMW3 increased from 0.24 feet in 1994 to approximately 2 feet in 1997, and PKMW4, which did not contain oil in 1994, had 0.13 feet apparent thickness of oil in 1997.
- Raviv (1994) used observations and measurements of the confined groundwater zone in the area near the Canal and north of the bulkhead to determine that it was "unlikely that [oil] seepage from the deep confined groundwater zone contributes a volume of oil which could be identified and measured relative to the existing volume of oil in the Canal."

14.7 Free Oil Pump Testing Results

As part of the FORP, free oil pump tests were performed at wells PKCMW3 and PKMW1, which are located in Plumes 15 and 16, respectively (Table 14-4). Both wells are outside the area of tidal influence in the unconfined groundwater zone based on the two rounds of low and high tide water level measurements. Also, information on oil recovery pump testing at well PKMW11 in Plume 16a (the confined zone) was obtained from Raviv (1995). The detailed FORP results are contained in **Appendix O**.

- At well PKCMW3 (Plume 15), no sustained recovery of oil could be maintained during the skimming, total dual fluids and vacuum enhanced pumping tests. During the FORP dual fluids pump test, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate between 1.60 gpm and 2.10 gpm.

- At well PKMW1 (Plume 16), no sustained recovery of free oil could be achieved for any of the three tests performed (Table 14-4). During the dual fluids test, the radius of groundwater influence was greater than 50 feet, using a groundwater pumping rate between 0.68 gpm and 0.90 gpm.
- At well PKMW11 (Plume 16a), Raviv (1995) conducted a series of short-term pumping tests to evaluate the feasibility of free oil recovery from the confined zone. During the free oil skimming test the free oil recharge rate into the well ranged from 0.005 gpm to 0.024 gpm. During the dual fluids pumping test the oil recovery rate was between 0.008 gpm and 0.051 gpm.

14.8 Description of Existing Free Oil Recovery System

- Currently, there is no free oil recovery system in the Platty Kill Canal Area.
- At Plume 15, Exxon monitors free oil thickness and vacuums out product (and water) from well GMMW12 twice a week.
- At Plume 16, Exxon monitors free oil thickness and vacuums out product (and water) from well EB19 twice a week.
- At Plume 16a, Exxon monitors free oil thickness and vacuums out product (and water) from wells PKMW11, PKMW12, and PKMW14 twice a week.

14.9 Conceptual Strategies for Free Oil Recovery Design

14.9.2 Plume 15:

- At well PKCMW3 (Plume 15), no sustained recovery of oil could be maintained during the skimming, total dual fluids and vacuum enhanced pumping tests. During the FORP dual fluids pump test, the radius of groundwater influence was between 10 feet and 50 feet, using a groundwater pumping rate between 0.68 gpm and 0.90 gpm.
- There is no existing free oil recovery system that could be upgraded and expanded at Plume 15.
- At Plume 15, sustained free oil recovery is not practicable at this time, based on a comparison to the 0.1 gpm recovery rate criterion. A combination of factors make the recovery of free oil at Plume 15 difficult. First, no sustained free oil could be recovered during the pumping tests. Second, the GC fingerprint results indicated that the heavy character of these oils probably limits their mobility in the subsurface (the viscosity of the oils was relatively high). Third, the oil occurs over a relatively large area with only one central area of thicker oil, which has a true thickness of less than 0.5 feet. Therefore, a reasonable conceptual long term remedial approach for this plume is remediation through *in-situ* degradation, especially since the oil has a low total VOC component. Conceptual methods to be evaluated also include, periodic pumping of oil from the central location of the plume.
- At Plume 15 the following additional information should be considered for the design of a free oil recovery system: 1) The west-central half of the plume is overlain by 5 to 20 feet of fill/debris excavated from the Pier 1 area (new bulkhead installation), which is mostly impenetrable using a hollow stem auger drilling rig (during the FORP 6 to 10 attempts were unable to drill through either the fill or the underlying concrete floor or foundations, or materials associated with an abandoned rail line through the area); 2) West Plant access agreement required, with utilities virtually unknown in the area; 3) Oil pipeline along the northern edge of the plume (along railroad); and 4) The area

along the west perimeter of the lube plant and adjacent to the Platty Kill Canal was identified as an area of high chromium contamination;

14.9.3 Plume 16:

- No sustained recovery of free oil could be achieved using either the skimming, total dual fluids pumping or vacuum enhanced pumping at a well in the southwestern portion of the plume.
- There is no existing free oil recovery system that could be upgraded and expanded at Plume 16.
- At Plume 16, sustained free oil recovery is not practicable at this time, based on a comparison to the 0.1 gpm recovery rate criterion. A combination of factors make the recovery of free oil in vertical pumping wells at Plume 16 difficult. First, no sustained free oil recovery could be achieved during the pump testing. Second, the GC fingerprint results indicated that the heavy character of these oils probably limits their mobility in the subsurface (the viscosities were relatively high). Therefore, intermittent free oil skimming from wells installed in the horseshoe shaped true thickness plume is a conceptual method to be evaluated. In addition, a conceptual method to be evaluated includes using a small oil recovery trench on the upgradient side of the Canal retaining wall to capture oil that might eventually migrate toward the Canal.
- At Plume 16 the following additional information should be considered for the design of a free oil recovery system: 1) The area is presently clear of most buildings with the exception of the NE portion of plume 16a where a small tank field (this tank field is one of the oldest remaining on site) is present over the plume; 2) Within the area, numerous foundations and floors remain from demolished/abandoned facilities including a tank field, a MEK plant and a wax plant; 3) Maps show when two railroad spur lines ran through the area (now abandoned without any detailed surface evidence); 4) Condition and impact of Platty Kill Canal bulkhead walls are unknown; and 5) The area along the west perimeter of the lube plant and adjacent to the Platty Kill Canal was identified as an area of high density chromium contamination, with medium density sites identified in other parts of the area.

14.9.3 Plume 16a:

- At Plume 16a, Raviv (1995) conducted a series of short-term pumping tests to evaluate the feasibility of free oil recovery from the confined zone. During the free oil skimming test the free oil recharge rate into the well ranged from 0.005 gpm to 0.024 gpm. During the dual fluids pumping test the oil recovery rate was between 0.008 gpm and 0.051 gpm.
- There is no existing free oil recovery system that could be upgraded and expanded at Plume 16a.

At Plume 16a, sustained free oil recovery is not practicable at this time, based on a comparison to the 0.1 gpm recovery rate criterion. A combination of factors make the recovery of free oil at Plume 16a difficult. First, sustained free oil recovery rates were below the 0.1 gpm criteria established in the FORP Workplan. Second, although the GC fingerprint results indicated that the heavy character of these oils probably limits their mobility in the subsurface (the viscosities were relatively high). Third, the oil occurs in the confined groundwater zone. However, at Plume 16a, conceptual oil recovery methods to be evaluated include intermittent oil skimming from large diameter wells. Because the oil skimming recovery rates were below the 0.1 gpm benchmark, intermittent recovery is the most appropriate method. Recovery of free oil from Plume 16a in the confined zone has an added advantage over recovery in the unconfined zone in that the wells, which are screened in the confined zone, act as natural collection areas for the oil (i.e., the oil preferentially collects in these wells).

Table 14-1

Baildown Testing Results for Plumes 15 and 16

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness in Well (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
Plume 15						
7/23/97	PKCTMW1	P	0.71	0.06	12.14	
8/13/97	PKCTMW14	P	1.77	0.15	11.80	

11.97 Average Exaggeration Ratio

4	Applied Exaggeration Ratio
---	----------------------------

Plume 16						
7/24/97	PKMW1	P	0.91	0.30	3.03	
9/13/94	EB19	R	1.93	0.49	3.94	

3.49

3.5	Applied Exaggeration Ratio
-----	----------------------------

Table 14-2

Free Oil Analysis Information for Plumes 15, 16, and 16a

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
PKCTMW14 (Plume 15)	Mid-range lube oil	0	64	36	36,600	6,800	26.1	NA
GMMW12 (Plume 15)	Severely weathered crude oil; small amount of an unspecified gasoline-range product	3	54	44	NA	NA	603.0	NA
PKMW8 (Plume 15)	NA	NA	NA	NA	NA	NA	112.3	0.929
SSB1 (Plume 15)	NA	NA	NA	NA	NA	NA	NA	0.916
PKMW1 (Plume 16)	Mid-range lube oil	2	67	31	1,232,040	8,040	16.7	NA
PKCTMW15 (Plume 16)	Lube oil (e.g., crankcase oil)	1	39	60	NA	NA	60.0	NA
EB19 (Plume 16)	NA	NA	NA	NA	NA	NA	77.5	0.917
PKMW11 (Plume 16a)	Moderately weathered crude oil; minor gasoline range product	6	73	20	5,741,000	0	9.3	0.883
PKCTMW12 (Plume 16a)	Moderately weathered crude oil or heavy fuel oil (#6 fuel oil)	1	58	40	3,113,100	189,100	19.5	NA
PKMW12 (Plume 16a)	NA	NA	NA	NA	NA	NA	7.1	0.860
PKMW14 (Plume 16a)	NA	NA	NA	NA	NA	NA	36.3	0.911

Notes:

NA=Not Available

Table 14-3

Soil Profile Data for Plumes 15, 16, and 16a

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
Plume 15				
PKCMW1T-2	2.0 - 2.5	59.80	9.18	0.47
PKCMW1T-4	4.0 - 4.8	11.40	21.12	0.59
PKCMW1T-6	6.0 - 7.2	7.50	23.19	0.54
Plume 16				
PKCMW2T-2	2.0 - 2.7	3.74	17.01	0.61
PKCMW2T-4	4.0 - 5.2	22.80	18.97	0.51
PKCMW2T-6	6.0 - 6.1	4.49	NA	N/A
Plume 16a⁽⁴⁾				
PKMW13	17.5 - 18.0	19.9	44.90	0.57
PKMW13	21.0 - 21.5	0.3	80.90	0.25
PKMW13	23.5 - 24.0	0.0	86.10	0.25
PKMW14	16.5 - 17.0	9.6	70.60	0.27
PKMW14	18.5 - 19.0	1.2	90.10	0.18
PKMW15	17.5 - 18.0	0.8	84.70	0.29

Notes:

(1) NA = Not Available

(2) The depth to water in PKCTMW1T (Plume 15) was approximately 6 feet below the ground surface.

(3) The depth to water in PKCTMW2T (Plume 16) was between approximately 5.2 feet to 6.0 feet below the ground surface.

(4) Confined groundwater zone; the data were obtained from Raviv (1995).

Table 14-4

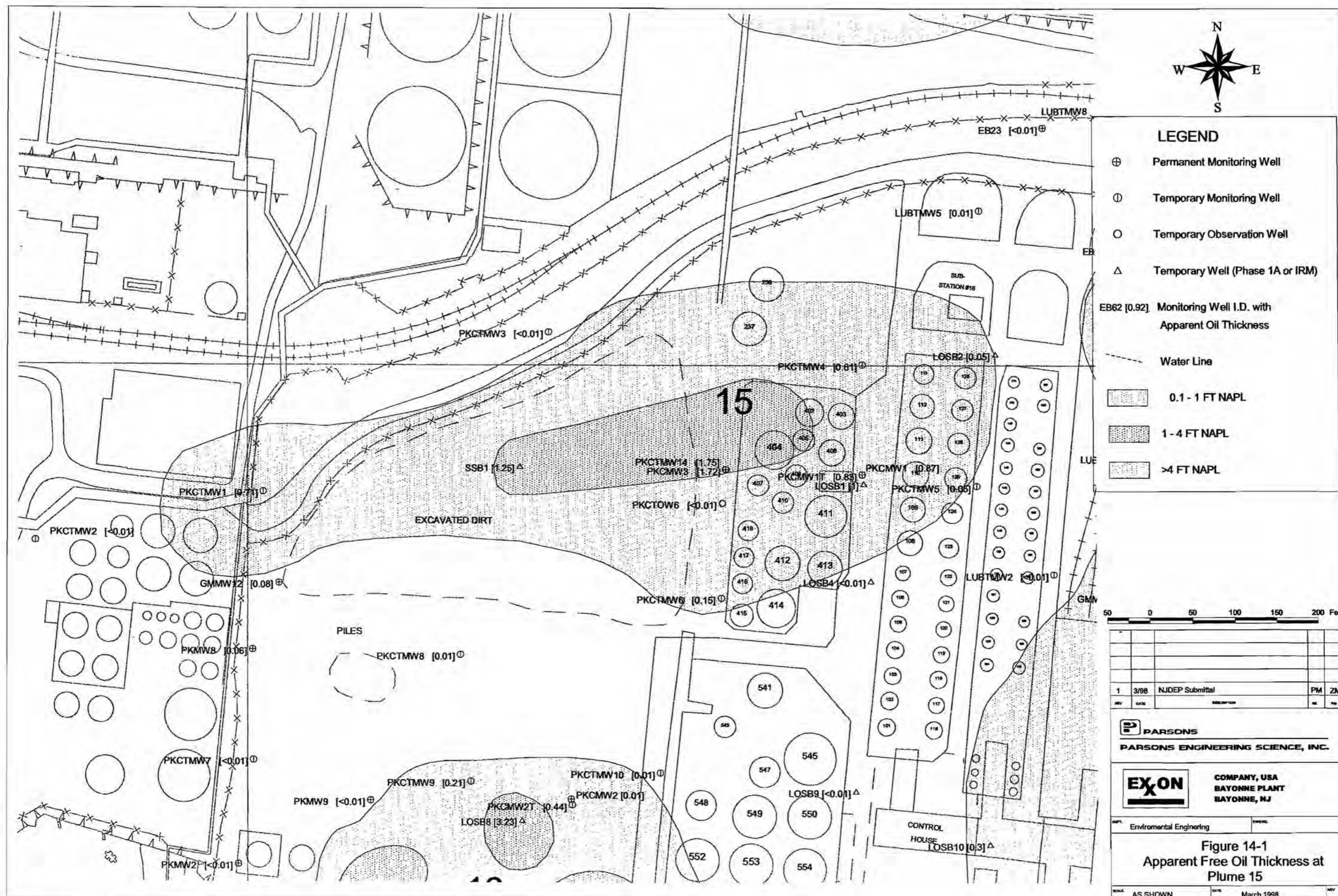
Pump Test Results for Plumes 15, 16 and 16a

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well ID	NAPL Skimmer Tests				Total (dual) Fluids Pumping Tests								Vacuum Enhanced Total (dual) Fluids Pumping Tests								
	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)	Ground Water Pumping Rate (gpm) Q	Sustained Ground Water Drawdown (feet) s	Specific Capacity (gpm/ft of drawdown) Q/s	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)	
PKMW1 (Plume 16)	8/12/97	P	90	0.000	8/12/97	P	35	0.000	>10	<50	0.68	1.7	0.405	8/12/97	P	103	0.000	>50	1.8	2.2	48
					8/12/97	P	55	0.000	>10	<50	0.90	3.2	0.279	8/13/97	P	90	0.000	>50	2.6	3.0	48
PKCMW3 (Plume 15)	9/11/97	P	90	0.000	9/12/97	P	90	0.000	>50		2.10	1.2	1.765	9/12/97	P	80	0.000	>50	1.5	0.3	47
					8/11/97	P	40	0.000	>50		1.60	1.1	1.481								
PKMW11 (Plume 16A)	11/1/94	DRI	142	0.024	11/1/94	DRI	30	0.019	NA		0.93	NA	NA	No Test							
	11/2/94	DRI	143	0.005	11/3/94	DRI	205	0.030	NA		NA	NA	NA								
					11/4/94 (HT)	DRI	220	0.008	NA		NA	NA	NA								
					11/4/94 (LT)	DRI	180	0.051	NA		1.90	NA	NA								

Notes:

NA = Not Available



LEGEND

- ⊕ Permanent Monitoring Well
- ⊙ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)
- EB62 [0.92] Monitoring Well I.D. with Apparent Oil Thickness
- Water Line
- 0.1 - 1 FT NAPL
- 1 - 4 FT NAPL
- >4 FT NAPL

50 0 50 100 150 200 Feet

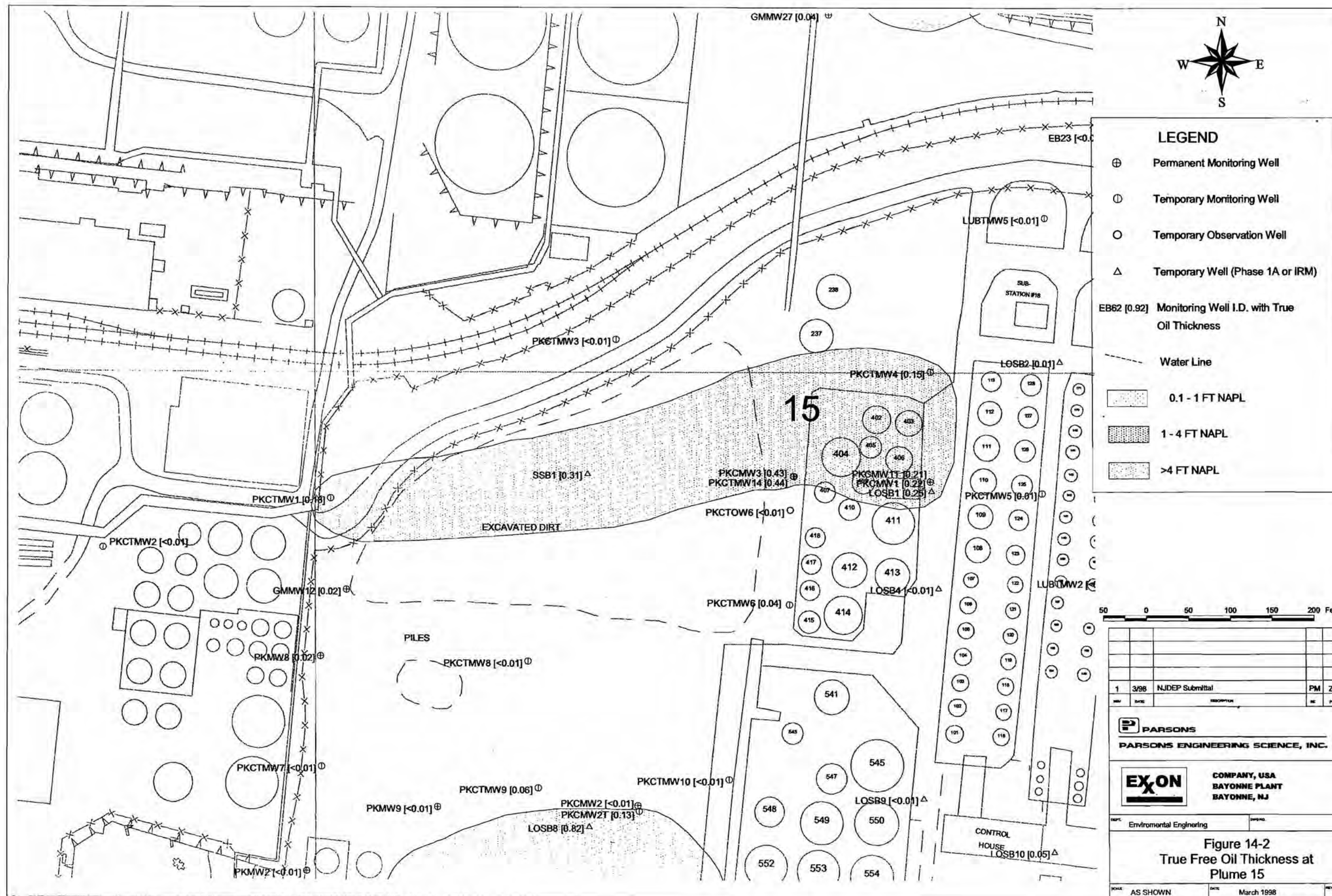
1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK

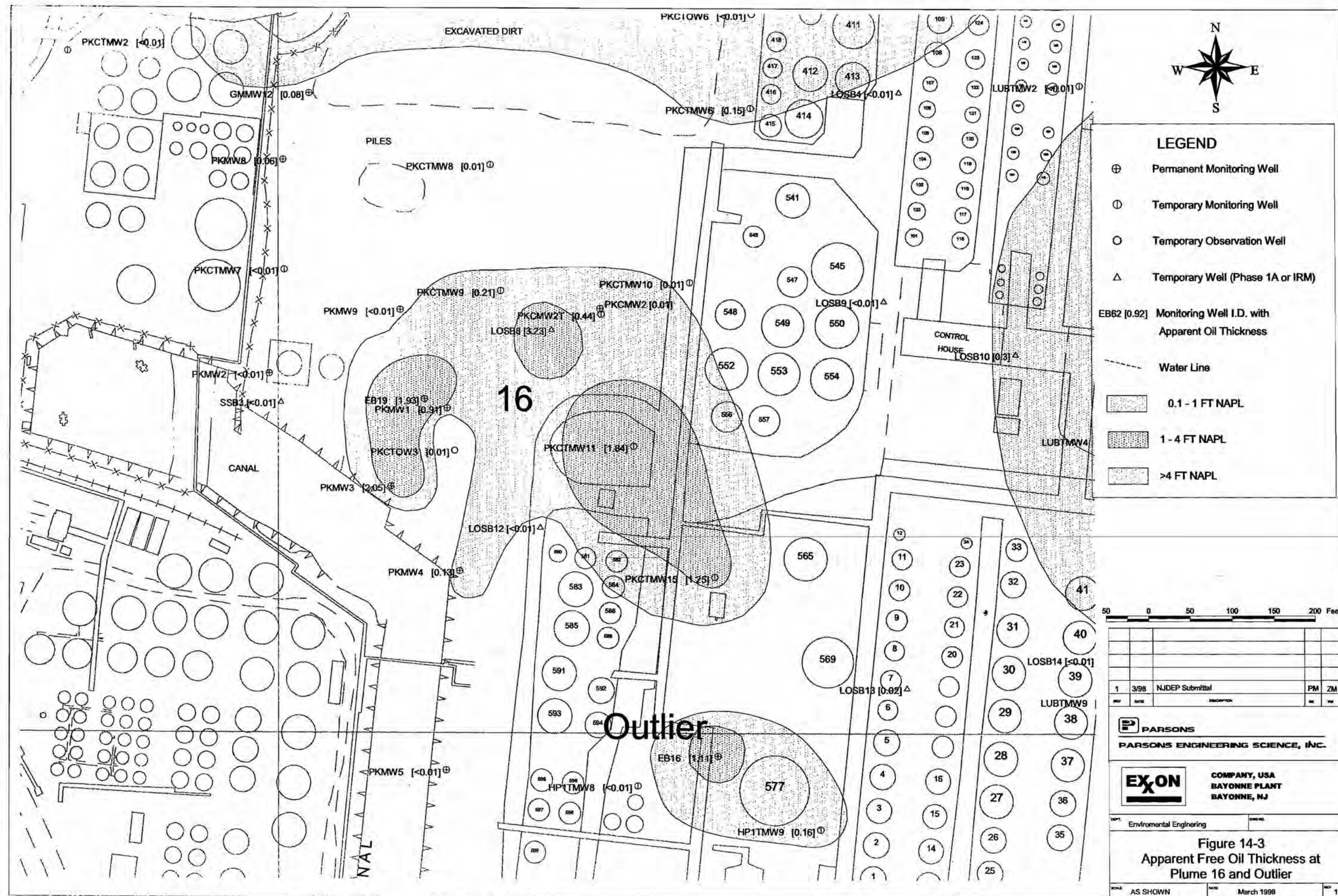
PARSONS
PARSONS ENGINEERING SCIENCE, INC.

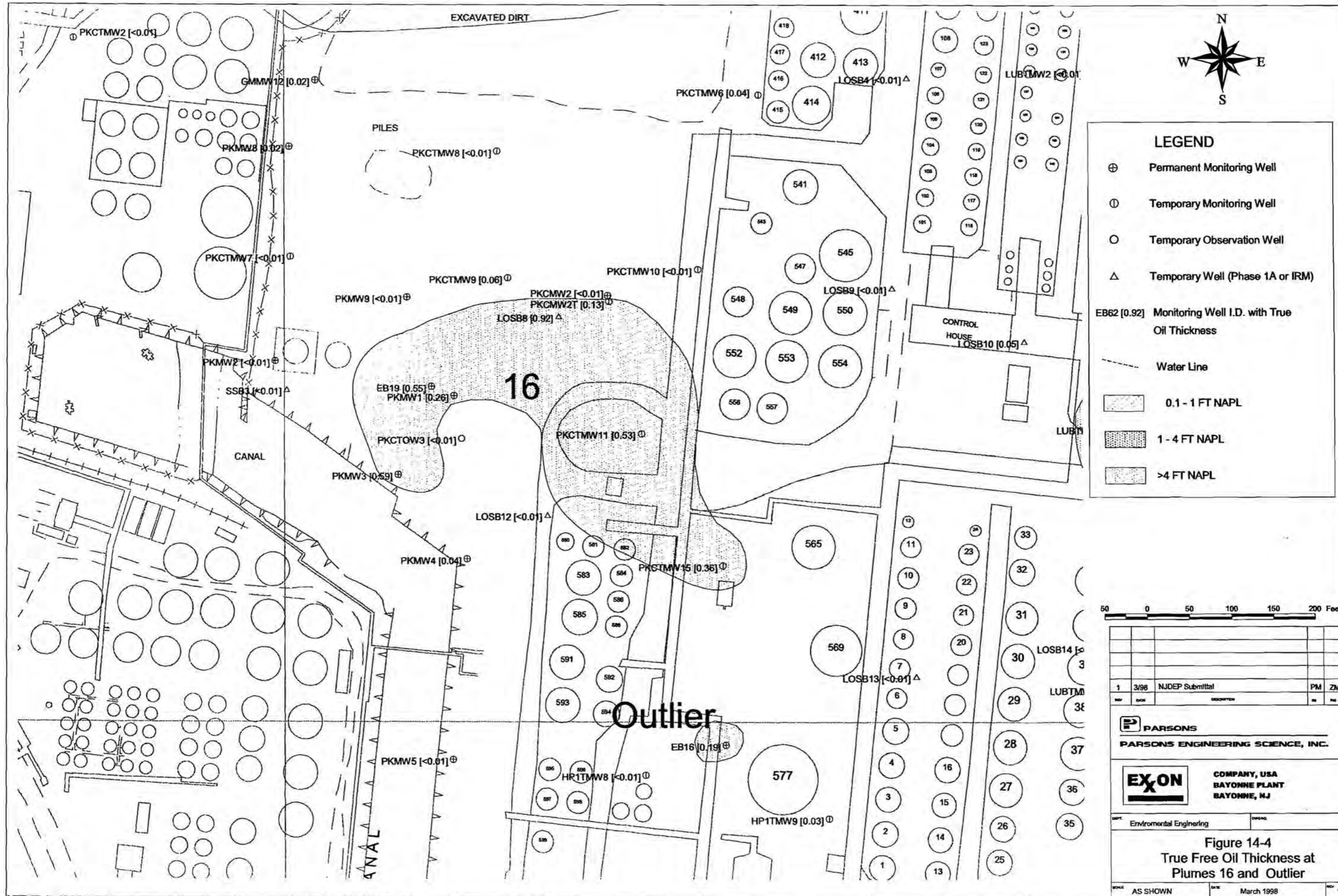
EXXON COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

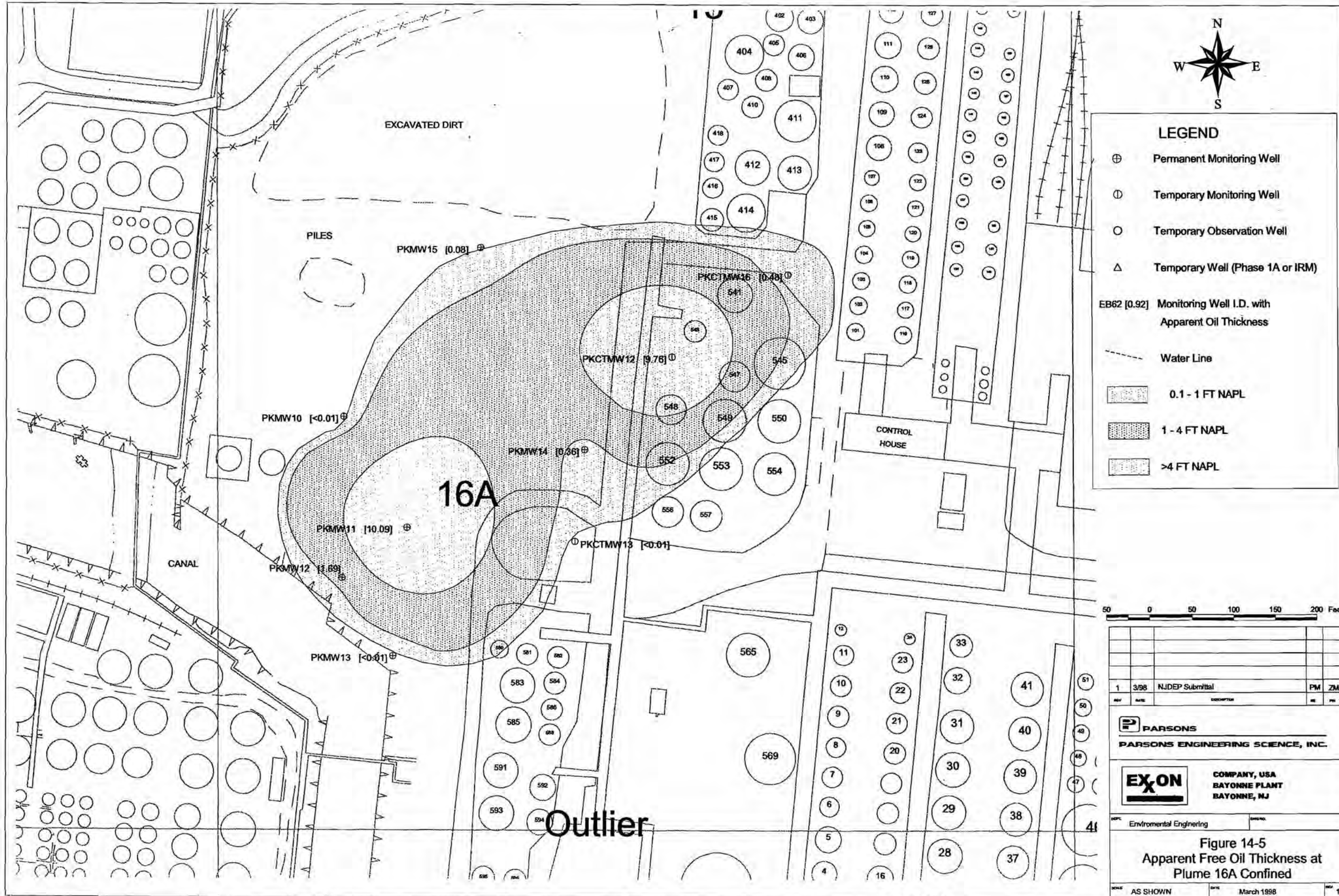
DEPT. Environmental Engineering DRAWING

Figure 14-1
Apparent Free Oil Thickness at
Plume 15









LEGEND

- ⊕ Permanent Monitoring Well
- ⓪ Temporary Monitoring Well
- Temporary Observation Well
- △ Temporary Well (Phase 1A or IRM)

EB62 [0.92] Monitoring Well I.D. with Apparent Oil Thickness

--- Water Line

0.1 - 1 FT NAPL

1 - 4 FT NAPL

>4 FT NAPL

50 0 50 100 150 200 Feet

1	3/98	NJDEP Submittal	PM	ZM
REV	DATE	DESCRIPTION	BY	CHK



PARSONS ENGINEERING SCIENCE, INC.



COMPANY, USA
BAYONNE PLANT
BAYONNE, NJ

Environmental Engineering

Figure 14-5
Apparent Free Oil Thickness at
Plume 16A Confined

15.0 Plume 17 and Outlier Plume (Helipad and Pier 1 Areas)

15.1 Introduction

- Plume 17 and the Outlier Plume exists at the Helipad and Pier 1 Areas (**Figure 15-1** and **Figure 15-2**; **Figure 14-3** and **Figure 14-4**).
- Currently, the Helipad and Pier 1 Areas consist of an active pier that is used for the loading and unloading of the contents of marine vessels at the Plant. Oil transfer pipelines in elevated racks connect Pier 1 to the Lube Oil Area (Geraghty & Miller, 1995). Historical (in 1940) operations in this area included a Compounding Plant, a shipping warehouse, and a barrel handling area. The Helipad was built around 1970.

15.2 Field Work

15.2.1 Free Oil Delineation Tasks

- Eight temporary wells were installed at the Helipad Area (HP1TMW1 through HP1TMW8), as specified in the Workplan. NJDEP permits for the installation of these wells are included in **Appendix P**.
- Installed one permanent well at Plume 17 (HP1MW1), as specified in the Work Plan.
- As required by the Workplan, performed 2 soil borings and collected samples from each. Collected 2 soil samples from HP1SB1 (two less than specified in the Workplan due to the short length of the vadose zone). Collected 2 soil samples from HP1MW1T (two less than specified in the Workplan due to the short length of the vadose zone). Submitted these samples for analysis of FORP Workplan design parameters (% residual oil, % water, porosity, and bulk density). Also, at each of these two borings, and another boring HP1TOW2, one soil sample was collected within the oil zone at the water table for grain size analysis (total of 3 samples - 1 more than specified in the Workplan). [samples were originally proposed in boring HP1SB2 near EB10, but poor shelby tube sample recoveries were obtained for the entire length of the boring, and no samples were collected.
- Measured the apparent thickness of oil in all existing and proposed wells in the Helipad Area in accordance with the Workplan. In total, 13 measuring events were taken.
- Performed free oil characterization on 2 samples, as specified in the Workplan. The following analyses were performed: 1) GC fingerprinting: EB10 and EB12; 2) VQA: EB10 and EB12; 3) Viscosity: EB10 and EB12.

15.2.2 FORP Design Support Tasks

- As specified in the Workplan, performed 4 baildown tests in the Helipad Area (EB10, EB12, EB16, and EBR6).
- Performed free oil recovery rate testing at 2 wells (EB10 and EB12), as specified in the Workplan.
- Prior to the test at EB10, installed three observation wells at 5, 10, and 50 foot intervals from the well (HP1TOW1 through 3), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping, and vacuum enhanced testing at well EB10.

- Prior to the test at EB12, installed three observation wells at 5, 10, and 50 foot intervals from the well (HP1TOW4 through 6), as required by the Workplan. Performed free oil skimmer testing, total dual fluids pumping and vacuum enhanced pumping tests at well EB12.

15.3 Description of Hydrogeology

The hydrogeology of the Helipad and Pier 1 Areas is summarized in the following bulleted items:

- The subsurface materials generally consist of fill to depths of between 12 and 18 feet below the ground surface. At the Helipad and Pier 1 Areas, the fill was composed of mostly fine sand with medium to coarse sand components, and slag, wood, concrete and brick fragments. In most locations within the Helipad area, the sandy fill contained a silt/clay zone that was encountered between 4 feet and 6 feet below the ground surface, and was from 1 foot to 2 feet thick (HPTOW1, HP1TMW1, 2, 3, and 4 and PN1SB2); it is noticeably absent in the northern portion of the area. Below this sandy fill with a silt layer (noted above), was another gray silt layer that contained some wood fragments (HP1MW1) at 10 to 12 feet, and which extended to at least 17 feet. According to Raviv (1995), the gray silt is underlain by a brown clay glacial till with gravel, silt, and sand.
- In the vicinity of where the thickest apparent free oil was measured at Plume 17, the subsurface material near the water table consisted of very fine to fine sand with some/trace silt (HP1MW1, HP1TMW7), although in some locations a 1 to 2 foot silt zone was encountered near the water table (HP1TOW1).
- Grain size analysis of a soil sample collected near the water table (from 6.0 feet to 7.6 feet) in a boring performed adjacent to EB12 indicated that the subsurface material contained approximately 10% silt and clay, 14% fine sand, and the remaining 76% was composed of coarser sand and gravel particles. Grain size analyses from two other borings within the central and southern portions of plume (HP1MW1T and HP1TOW2, respectively) contained approximately equal amounts of silt (27-28%) and fine sand (22-23%), and the remaining approximately 50% was composed of coarser sand and gravel particles. The results of the latter two analyses are generally consistent with the soil description from Plume 17 given above.
- An unconfined groundwater zone is present in the fill on-site, and groundwater in the Helipad and Pier 1 Areas is generally between 5 feet and 10 feet below the ground surface.
- The groundwater flow direction in the Pier 1 Area is predominantly to the south (**Figure 3-1**). However, there is a groundwater mound that exists in the west-central portion of the Helipad that directs groundwater flow mostly to the southeast, but there is also some flow to the southwest. Raviv (1995) indicates that groundwater flow is preferentially toward the southeast because of the deteriorated condition of the sheet pile bulkhead on the east side of the Helipad (which would be more permeable), whereas the southern and western sides are composed of concrete (and would be less permeable). The hydraulic gradient is 0.01 in the east-central portion of the Helipad Area.
- The unconfined groundwater zone is influenced by tidal fluctuations based on an analysis of depths to water taken in monitoring wells at low and high tides. The tidal influence affected three wells on the Helipad, all of which were in the southeastern portion. The influence extends approximately 100 feet inland.

15.4 Free Oil Delineation Results

15.4.1 Apparent Free Oil Thickness

- Plume 17 and the Outlier Plume are defined to 0.1-foot apparent thickness contour on the Exxon facility, as required by the FORP Workplan (**Figure 15-1** and **Figure 14-3**). A total of 30 wells were used for the delineation of these plumes. The horizontal extent of the Plume 17 and the Outlier Plume has been confirmed, and no further delineation is required.
- Plume 17 is an irregularly shaped plume that trends in a roughly northeast-southwest direction (although it has a northern extension) in the Helipad Area. The northeast-southwest elongation of the plume is consistent with the expected directions of groundwater flow, considering that a groundwater divide exists in this area of the site. The maximum apparent free oil thickness was 3.50 feet at well EBR8 (**Figure 15-1**).
- The Outlier Plume is oval-shaped. The maximum apparent free oil thickness was 1.11 feet (**Figure 14-3**).

15.4.2 True Free Oil Thickness

- The true free oil thickness at Plume 17 is comprised of two areas of free oil that are greater than 0.1 feet (**Figure 15-2**). The maximum true free oil thickness was 0.58 feet at EBR8.
- The true free oil thickness at the Outlier Plume is comprised on one small area around EB16 (**Figure 14-4**). The maximum true free oil thickness was 0.19 feet at EB16.
- An exaggeration ratio of 6 was used for Plume 17 and the Outlier Plume.

Derivation of Exaggeration Ratio: The exaggeration ratio at Plume 17 and the Outlier Plume was derived using results from subsurface soil descriptions and analyses, ratios of apparent to true free oil thickness published by EPA (1996), and 4 baildown tests completed at the Helipad Area (**Table 15-1**). The subsurface material near the water table consisted of very fine to fine sand with some/trace silt, and in most areas there is a silt layer (1-2 feet thick) near the water table. These descriptions correspond to a soil type of between sandy loam and loam, using the soil types given on the exaggeration ratio chart cited in EPA (1996); the silt layer would correspond to a silt loam. According to EPA (1996), the ratio of apparent to true free oil thickness for a soil between these two types has a range of between approximately 2 and 6; an 8 would be appropriate for the silt layer. Furthermore, the exaggeration ratios from three baildown tests ranged from 7.10 to 9.52; the average exaggeration ratio was calculated to be 8.91. Therefore, given the available data, an exaggeration ratio of 6 was used for Plume 17 and the Outlier Plume. This is slightly lower than the average ratio because the 1-2 foot silt layer is not prevalent at all locations of the site and therefore, may not have the same (i.e., increased) effect on oil exaggeration over the entire site. The apparent free oil thickness and true free oil thickness data and graphs for the baildown tests at this plume are contained in **Appendix P**.

15.5 Free Oil Analytical Results

GC fingerprint, VOA, viscosity, and specific gravity free oil characterization results for Plume 17 are included on **Table 15-2**.

- The two samples from the Plume 17 Area (EB10 and EB12) appeared to contain mixtures of lube oil with a "background" weathered crude oil (**Table 15-2**).

- The fact that the two oils from EB10 (in the main body of the plume) and EB12 (in the northern portion of the plume) are similar provides support for joining the main body of the plume to the northern extension (i.e., Plume 17 is one continuous plume).
- The specific gravity of the free oil collected from nine wells (7 from a previous study and 2 from the FORP investigation) ranged between 0.885 and 0.995.
- Analysis of soil profile samples collected from a soil boring HP1SB1, (approximately 5 feet from well EB12), showed that the percent of oil and grease decreased with depth (**Table 15-3**). This profile suggests that free oil may have been released at this location. At HP1MW1T, which is south of this location, the profile showed no trend. The laboratory data for percent oil is contained in **Appendix P**.

15.6 Potential Sources of Free Oil

Historical areas of potential sources of free oil at the Helipad and Pier 1 Areas include above ground storage tanks, drum storage areas, loading and unloading areas, process areas and storm sewers (Geraghty & Miller, 1994).

The following bullets outline evidence for correlations, where they exist, between the current distribution of the apparent free oil plumes on-site and the potential source areas identified at the Helipad and Pier 1 Areas:

- There are no documented releases of oil in the Helipad Area according to Geraghty & Miller (1994).
- There were several operational features that occurred within the footprint of the Plume 17. These included a shipping warehouse, which covered the entire area of the plume, and tar seeps, which occurred in the east-central portion of the plume, south of well EB11. Based on their physical association, these operational features are potential sources of oil found at Plume 17.
- While it is likely that there were other sources of oil at Plume 17, a portion of lateral sewer line 1N may have contributed oil to the northern area of the plume. The portion of this line between MH1N-4 and MH1N-5 (in the northern portion of the plume) was badly deteriorated according to an IT Corporation (1997) survey. This line was formerly used to convey pumpage of total fluids (oil and water) from recovery wells in the general area to the West Side Separator for treatment. Because a portion of this line may have been at or just below the water table, there is a potential that oil was exfiltrated from this line and contributed oil to the plume in this area. Of course, this sewer line source implies that there was an additional source that released the main body of the oil. Considering the long operational history at this area, this is not unexpected.
- There were several operational features that occurred within the footprint of the Outlier Plume. These include two former oil/water separators and bulk storage tanks (1932 through 1968).

15.7 Free Oil Pump Testing Results

As part of the FORP, free oil pump tests were performed at well EB10 in the main body of Plume 17, and in EB12, which is in the northern extension of the plume (**Table 15-4**). Both of these wells were outside the area of tidal influence based on the two rounds of low and high tide water level measurements. Also, information on free oil recovery rates was obtained from a number of tests previously performed by Raviv (1995). The results of the FORP and Raviv (1995) tests presented below all indicate that free oil recovery rates are less than 0.1 gpm. The detailed FORP results are contained in Appendix P.

- At wells EB10 and EB12, no sustainable oil recovery was obtained during the skimmer, total (dual) fluids, or vacuum enhanced testing (**Table 15-4**); Raviv (1995) had previously reported recovery rates of less than 0.001 gpm for these same wells during skimmer tests. The lack of oil recovery from these wells may be due to the viscosity of the oils (**Table 15-4**). During the FORP dual fluids pump tests at these wells, the radius of groundwater influence was between 10 feet and 50 feet, using groundwater pumping rates of between approximately 1 and 2 gpm.
- At well EBR5 in the eastern part of the plume, Raviv (1995) reported a free oil recovery rate of up to 0.011 gpm during a dual fluids pumping test (pumping free oil and water) with a groundwater pumping rate of 4.3 gpm (**Table 15-4**). Using this same method, Raviv (1995) reported a similar free oil pumping rate at well EBR8 in the west-central portion of the plume; the groundwater pumping rate for this test was 2.0 gpm (**Table 15-4**).
- According to Raviv (1995), during skimmer tests at wells EB2, EB3, EB4, EB5, EB9, EBR6, and EBR3, little to no free oil was recovered.

15.8 Description of Existing Free Oil Recovery System

- There is an existing, but currently, non-functioning free oil recovery system in the Helipad area. The system consists of seven recovery wells (EBR1, EBR2, EBR3, EBR4, EBR5, EBR6 and EBR7) and a network of discharge pipes and sumps. These discharge lines tie into sewer line Lateral 1N in the northern portion of the Helipad Area. Recovery wells EBR2 through EBR4 are linked by discharge lines in the eastern portion of the plume; well EBR5 does not have any electric line, discharge pipe or pump (Raviv 1995). Wells EBR1, EBR6 and EBR8 are linked by discharge lines in the western portion of the plume. In 1990, the discharge lines were modified and connected by a 2-inch PVC pipe to the sewer lines that discharge to the West Side Treatment Plant (Raviv, 1995).
- Based on recent inspection, the wells and screens that are constructed of steel are all rusted, while those constructed of PVC appear to be in good condition. Also, it is possible that there are submersible pumps in four of the wells. Based on the poor condition of the piping and or electrical conduits that extended below the groundwater in these four wells, it is unlikely that any of the submersible pumps would be functional.
- No oil recovery system exists at the Outlier Plume.

15.9 Conceptual Strategies for Free Oil Recovery Design

15.9.1 Plume 17

- At Plume 17, sustained recovery of oil is not practicable at this time, based on the 0.1 gpm oil recovery criterion. The pumping test results performed during the FORP and by Raviv (1995) indicate that little to no sustained oil recovery could be achieved in most of the wells tested. At wells EBR5 and EBR8, Raviv (1995) reported oil recoveries of 0.011 gpm and 0.016 gpm using total dual fluids pumping. These rates are well below the 0.1 gpm recovery rate that was defined as reasonable for the FORP.
- There is an existing, but currently, non-functioning free oil recovery system in the Helipad area. The system consists of seven recovery wells and a network of discharge pipes and pumps. There is the potential to upgrade this system, and use sustained total dual fluids pumping to recover the oil, however, the pump testing results indicate that this method would not be effective in all locations of the plume.
- Another conceptual method for oil recovery to be evaluated includes an arc-shaped collection trench/drain on the downgradient side of Plume 17; the trench would collect free oil more efficiently than individual recovery wells. The need for multi-level collection pipes needs to be considered because tidal fluctuations in the Kill Van Kull Waterway affect groundwater levels. This collection trench could be tied into the West Side Treatment plant.
- At Plume 17 the following additional information should be considered for the design of a free oil recovery system: 1) The bulkheads that exist to the south and east are undermined and deteriorated; 2) An old railroad exists on the west side; 3) There is an extensive surface cover of foundations and floors from previous buildings in the area; the floors of these buildings are often undermined; 4) Numerous dirt piles of waste exist from previous remediation activities; and 5) Construction and demolition debris was found between foundations, with debris highly variable in amount and character over short distances.

15.9.2 Outlier Plume

- Recovery of oil at the Outlier Plume is not practicable because of the true thickness of the oil is only slightly greater than 0.1 feet in only one well (EB16). However, a conceptual method for free oil recovery includes natural or *in-situ* bioremediation with monitoring.

Table 15-1

Baildown Testing Results for Plume 17

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Test Date	Well ID	Data Source: P-Parsons R-Raviv	Apparent Oil Thickness for Design (feet)	True Oil Thickness in Formation (feet)	Exaggeration Ratio	Comments
7/22/97	EB10	P	0.71	0.10	7.10	
7/25/97	EB12	P	1.76	0.18	9.52	
7/25/97	EB16	P	1.11	0.12	9.52	
8/5/97	EBR6	P	1.27	0.13	9.52	tidal
					8.91	Average Exaggeration Ratio
					6	Applied Exaggeration Ratio

Table 15-2

Free Oil Analysis Information for Plume 17

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well I.D.	GC Fingerprint Summary Description	GRO (%)	DRO (%)	RRO (%)	Total VOC's (ug/Kg)	Total BTEX (ug/Kg)	Viscosity (cS)	Specific Gravity
EB10	Mixture of severely weathered crude oil admixed with a lube oil	2	46	52	1,270,000	0	397.7	0.901
EB12	Mixture of severely weathered crude oil admixed with a lube oil	1	31	68	359,470	5,770	53.3	0.910
EB2	NA	NA	NA	NA	NA	NA	32.3	0.894
EB3	NA	NA	NA	NA	NA	NA	NA	0.901
EB13	NA	NA	NA	NA	NA	NA	NA	0.995
EB16	NA	NA	NA	NA	NA	NA	NA	0.885
EBR4	NA	NA	NA	NA	NA	NA	11.5	0.876
EBR5	NA	NA	NA	NA	NA	NA	NA	0.885
EBR8	NA	NA	NA	NA	NA	NA	42.1	0.891

Notes:
NA=Not Available

Table 15-3

Soil Profile Data from Plume 17

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Sample No.	Depth (feet)	Oil & Grease (%)	Moisture (%)	Porosity
HP1SB1-2	2 - 2.7	15.20	NA	NA
HP1SB1-4	4 - 4.9	7.57	17.95	0.43
HP1MW1T-5	5 - 6.3	9.79	27.73	0.42
HP1MW1T-7	7 - 8.4	9.45	23.17	0.6
HP1TOW2-5	5 - 5.7	2.10	30.10	0.62

Notes:

(1) NA = Not Available

(2) The depth to water in HP1SB1 was between approximately 4.9 and 6 feet below the ground surface.

(3) The depth to water in HP1MW1T was approximately 8 feet below the ground surface.

(4) The depth to water in HP1TOW2 was approximately 11 feet below the ground surface.

Table 15-4

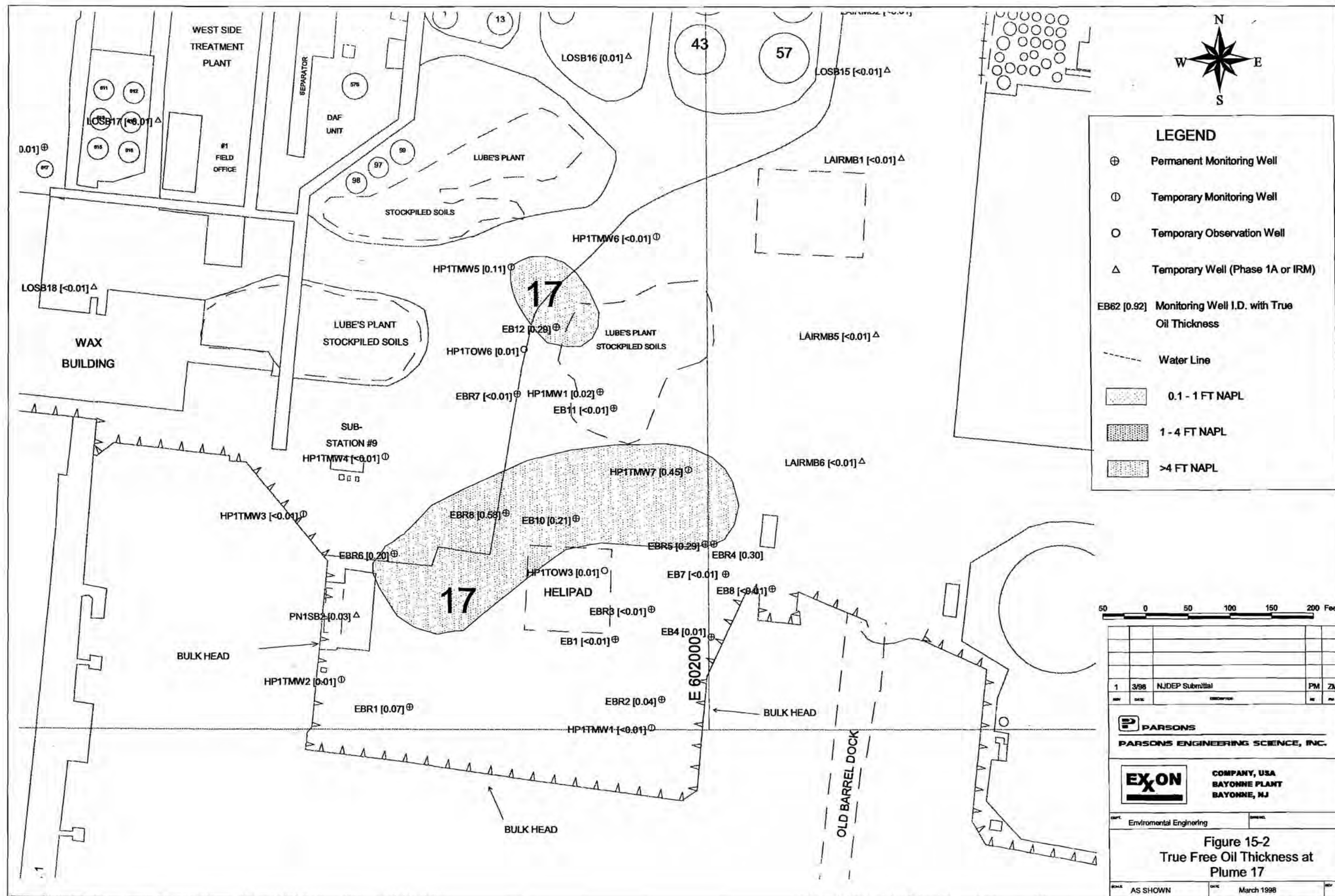
Pump Testing Results for Plume 17

Free Oil Recovery Project
Exxon Company, USA
Bayonne, New Jersey

Well ID	NAPI Skimmer Tests				Total (dual) Fluids Pumping Tests								Vacuum Enhanced Total (dual) Fluids Pumping Tests									
	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - gw (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Specific Capacity (gpm/ft of drawdown)	Date	S o u r c e	Duration (min.)	Stabilized Rate of Oil Recovery (gpm)	Radius of Influence - vac (feet)	Ground Water Pumping Rate (gpm)	Sustained Ground Water Drawdown (feet)	Applied Vacuum (in of H ₂ O)		
EB10	8/18/97	P	80	0.000	8/19/97	P	45	0.000	>10	<50	0.90	1.3	0.672	8/19/97	P	240	0.000	<5	4.9	0.4	50	
EB10	1/12/95	DRI	199	<0.001	8/19/97	P	65	0.000	>10	<50	2.50	3.4	0.729									
EB10	7/27/95	DRI	5908	<0.001																		
EB12	8/13/97	P	50	0.000	8/14/97	P	54	0.000	>10	<50	1.90	2.0	0.941	8/14/97	P	61	0.000	>10	<50	7.8	0.0	50
EB12	1/19/95	DRI	1337	<0.001	8/14/97	P	60	0.000	>10	<50	3.1	3.3	0.939									
EB12	7/27/95	DRI	6030	<0.001																		
EBR5	1/9/95	DRI	2663	0.007	8/2/95	DRI	1830	0.011	NA	NA	4.3	NA	NA	No Test								
	7/27/95	DRI	5889	0.002																		
	7/28/95	DRI	5380	0.008																		
EBR8	1/23/95	DRI	2684	0.000	1/23/95	DRI	339	NA	NA	NA	2.0	NA	NA	No Test								
EB2	7/27/95	DRI	6036	0.000	No Test									No Test								
EB3	7/27/95	DRI	6031	0.000	No Test									No Test								
EB4	7/27/95	DRI	6025	0.000	No Test									No Test								
EB5	7/27/95	DRI	6016	<0.001	No Test									No Test								
EB9	7/27/95	DRI	6006	<0.001	No Test									No Test								
EBR6	7/27/95	DRI	6009	<0.001	No Test									No Test								
EBR3	7/26/95	DRI	2661	<0.001	No Test									No Test								

Notes:

NA=Not Available



16.0 Waste Water Treatment Plants

There are currently two wastewater treatment plants located on the Bayonne facility, the East Side Treatment Plant and the West Side Treatment Plant. Both systems are currently in operation and appear to be working efficiently. The information about these plants will be used to determine if discharge (oil/water) from any new free oil recovery systems installed at the site can be treated by these plants.

16.1 East Side Treatment Plant

The East Side Treatment Plant includes an oil/water separator, as well as sand and carbon filters. The overall system capacity is 2,000 gpm. There is an overflow system in use (predominantly for excess flow due to heavy storms), which pumps the water to Tank 8553 in the General Tank Field using two 10,000 gpm pumps. This excess flow is subsequently treated prior to being discharged.

The influent enters the system and passes through a grit screen and over an oil drum separator. The oil is skimmed off the drum and sent to the oil collection tank. The wastewater then proceeds through a large separator. The separator previously had mechanically operating flights, however, due to chronic maintenance problems, the flights were recently removed. Now a fire hose is periodically used to spray water onto the top of the separator tank to force the oil to travel downstream toward the oil skimmers. The oil is skimmed off the water and sent to the oil collection tank.

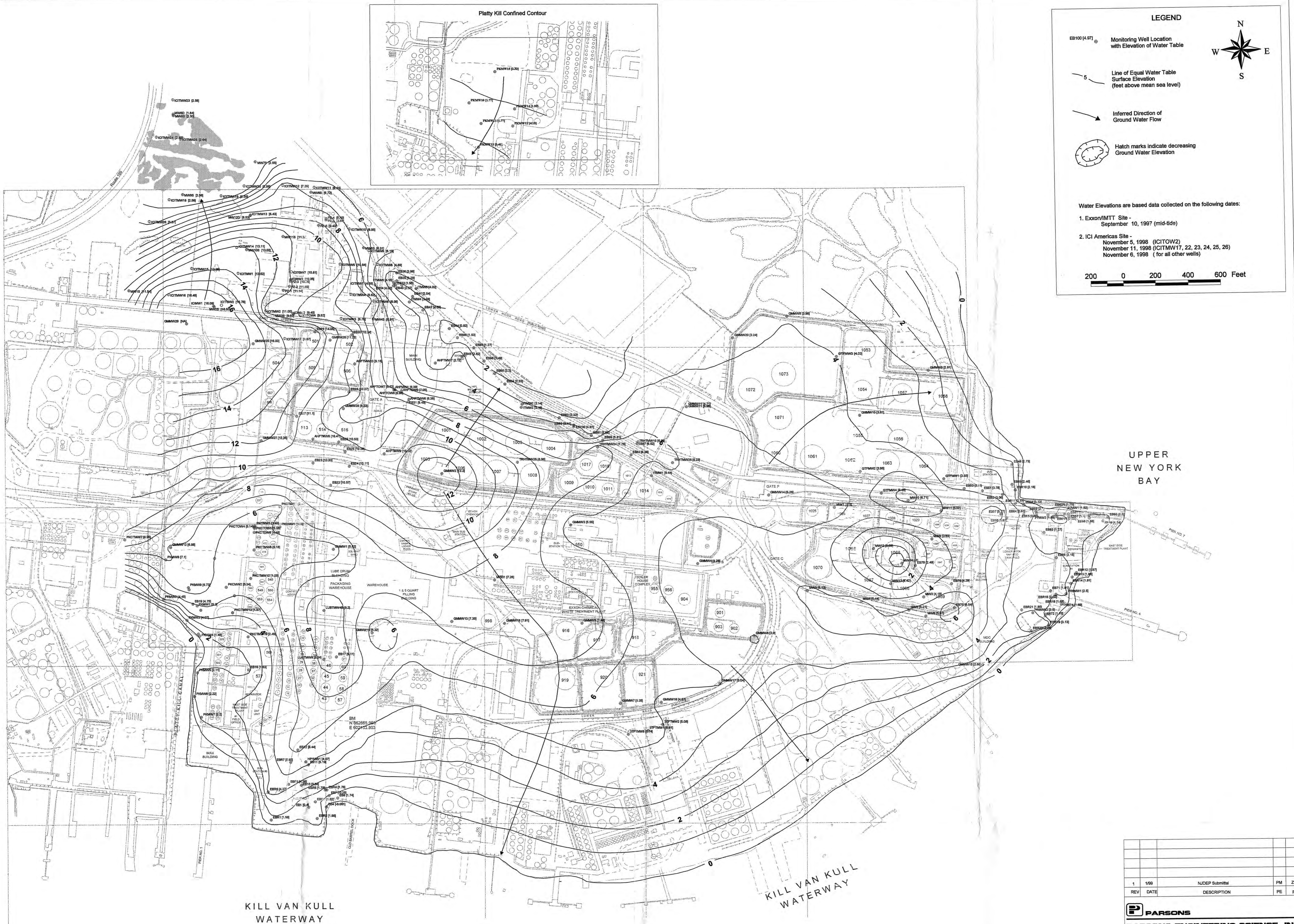
After passing through the separator, the water then passes over a weir to the lift station, where two pumps are used to send the water through four parallel sand filters, into a holding tank, and then through three parallel sets of two carbon units in series. The effluent then passes through a sink to allow weekly sample collection before being discharged directly into New York Bay. An automatic sampler is installed at the sink to allow collection of composite samples, if needed. The effluent from the East Side Treatment Plant is sampled according to NPDES permit requirements to ensure compliance with the New Jersey Department of Environmental Protection's requirements. The carbon units are backwashed based on the pressure differential through the beds. On average, the lead units are backwashed three times a week, and the polish units one time per week. Carbon changeouts are conducted approximately every six month by Calgon.



The oil from the collection tank is sent to the first of two oil storage tanks. The oil is allowed to settle in this tank (Tank 8198). The top fluid layer (oil) is transferred to the second waste oil tank (Tank 8199), the contents of which are periodically sold commercially. The bottom fluid layer (wastewater) is drained to the oil/water separator for treatment.

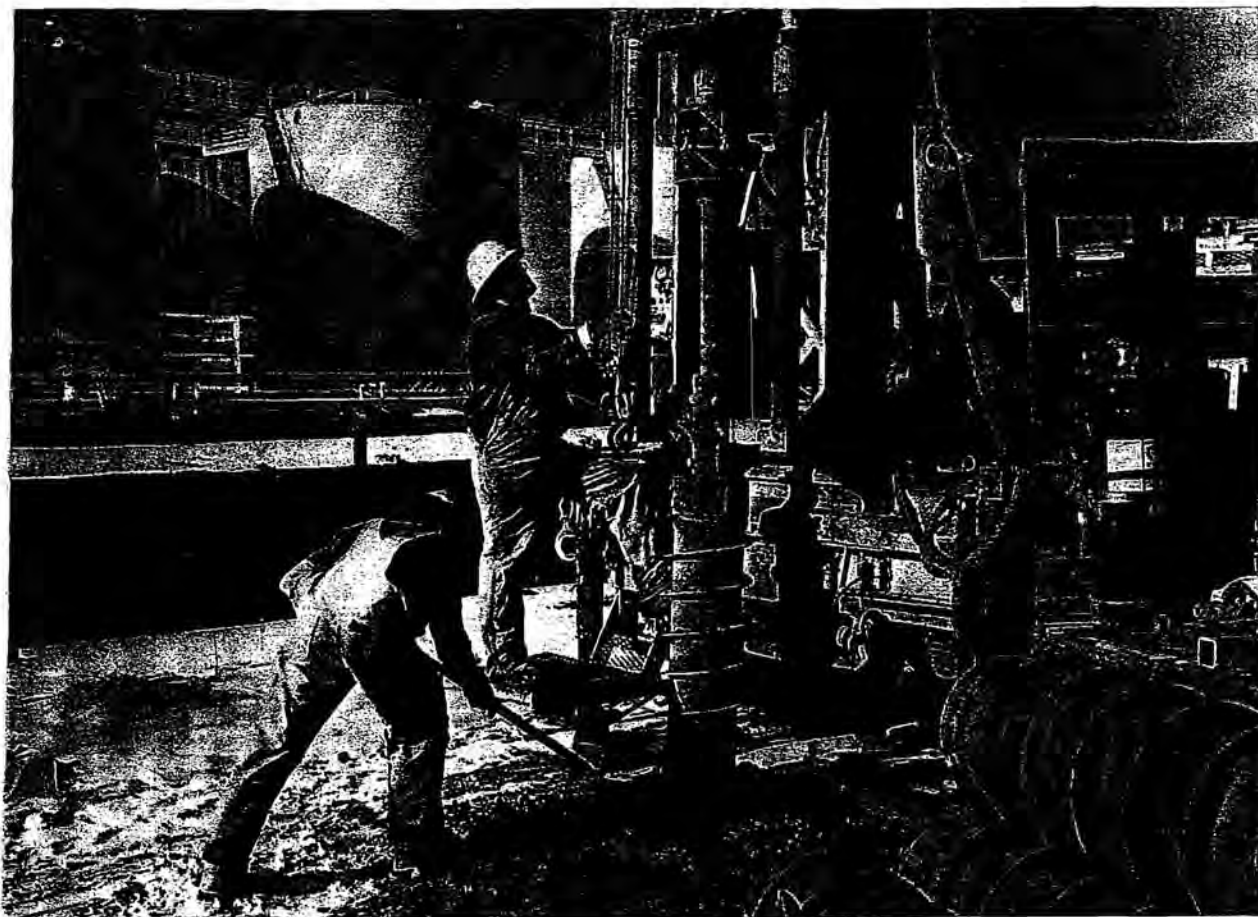
16.2 West Side Treatment Plant

The West Side Treatment Plant consists mainly of an oil/water separator and a dissolved air flotation unit. The influent to the treatment plant passes through a grit screen, up a vertical screw lift, and then proceeds to an American Petroleum Institute (API) separator with mechanical flights. The next process unit is a mixing tank, where coagulant is added to the wastewater. The wastewater then passes through a flocculation tank, followed by a dissolved air flotation (DAF) separator. The effluent from the DAF separator is then sent to the East Side Treatment Plant.

Oil is skimmed from the water surface at the API and DAF separators, as well as the flocculation tank. All three skimmers are piped to an oil storage tank. The oil is allowed to settle in the tank. The top fluid layer (oil) is transferred to a waste oil tank, the contents of which are periodically sold commercially. The bottom fluid layer (wastewater) is drained to the oil/water separator for treatment.



1	1/99	NJDEP Submittal	PM	Z
REV	DATE	DESCRIPTION	PE	F
<div> PARSONS</div> <div>PARSONS ENGINEERING SCIENCE, INC.</div>				
CLIENT/PROJECT TITLE:		<div> COMPANY, USA BAYONNE PLANT BAYONNE, NEW JERSEY</div>		
DEPT. ENVIRONMENTAL ENGINEERING		Dwg. No.		
<div>FIGURE 3-1 GROUND WATER CONTOUR MAP CENTRAL AND EASTERN CONSTABLE HOOK BAYONNE, NJ</div>				
SCALE:	1" = 200'	DATE:	JULY 1999	REV.



ExxonMobil

**Remedial Investigation
Addendum Report,
Sampling Clay-Till
Platty Kill Canal,
Bayonne, New Jersey**

Prepared for:

**Bayonne Industries Inc. and
ExxonMobil**

August 22, 2001

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August 28, 2001

IMT02PKC

Mr. Michael S. Kenney, Case Manager
New Jersey Department of Environmental Protection
Division of Responsible Party Site Remediation
Bureau of State Case Management
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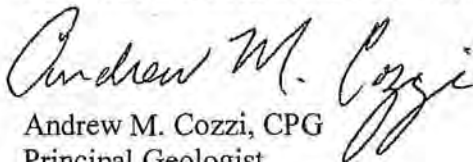
Re: Bayonne Industries, Inc., City of Bayonne, Hudson County, New Jersey
Remedial Investigation Addendum Report, Platty Kill Canal

Dear Mr. Kenney:

The original and three copies of the report entitled "Remedial Investigation Addendum Report, Platty Kill Canal" are enclosed for your review and distribution to the case team and Mark Walters. The Bayonne Industries' and ExxonMobil Certifications are included in Section 8 of the original report.

We are confident that this joint effort by ExxonMobil and Bayonne Industries will result in the completion of an acceptable closure of the canal. Should you have any questions, please feel free to contact me at (732) 873-6929.

Sincerely yours,
Bluestone Environmental Services, LLC


Andrew M. Cozzi, CPG
Principal Geologist

Encl.

cc: Mr. R. Fisette, IMTT
Mr. G. Bress, IMTT
Mr. E.J. Walker, IMTT
Dr. R. Weaver, IMTT
Mr. R. Scerbo, ExxonMobil

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- Figure 4 Clay-Till Thickness and Delineation Map with Historic Shoreline Overlay
Figure 5 Top of Clay or Till Layer Contour Map

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- Table 1 Summary of Permeability Analysis Results (January 2001)

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- Appendix A – Soil Boring Logs and well driller Boring Records
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Appendix C – Laboratory Permeability Test Results
Appendix D – Shelby Tube Lab Soil Logs
Appendix E – Vibrocore Lab Sediment Logs

1.0 INTRODUCTION

This Remedial Investigation Addendum Report (RIAR) presents the results of the investigative activities conducted in January 2001 in accordance with the Remedial Investigation Work plan Addendum (RIWA) dated August 2000. This work is intended to provide necessary data to progress the engineering plan for the closure of the Platty Kill Canal (PKC). A Remedial Action Work plan (RAWP) will subsequently be prepared with the intent of gaining closure approval and a "no further action" determination from the New Jersey Department of Environmental Protection (Department) for the PKC located on the border between Bayonne Industries, Inc. (BI) and ExxonMobil (EM) sites in Bayonne, New Jersey.

A Remedial Action Selection Report (RASR) on this project had been submitted to the Department in February 2000. The RASR outlined the rationale for the selected remedy and provided recommendations for filling data gaps necessary to develop a RAWP.

The anticipated final design will include containment of the sludge within the canal with selected sediment volumes being either treated in place or removed and treated for placement within the Platty Kill Pond (PKP). The PKC will be backfilled with dredge material and capped with low permeability material. An impermeable sheet pile barrier inside the perimeter of the canal will eliminate migration of any residual contamination from or into the canal site. Post construction monitoring programs will be established as part of the final plan.

1.1 Objectives

The objectives of the work, detailed in the Remedial Investigation Work plan Addendum (RIWA) are as follows:

1. Collect subsurface stratigraphic and permeability data necessary to confirm the feasibility and implementability of the selected remedial action.
2. Identify potential obstructions to sheet pile placement along the length of the canal that would preclude the installation of the vertical barrier.
3. Obtain an enhanced geologic characterization of the subsurface around and below the PKC sediments to confirm the presence of a continuous clay-till layer with sufficient thickness and impermeability to isolate any deposits retained in the canal.
4. Provide a response to the conditions in the Department's July 13, 2000, RASR approval letter to BI and EM.

1.2 Scope of Work

This report focuses primarily on the results of investigative activities conducted in March 2000 and January 2001 but also builds upon results obtained from earlier investigations (*PKC Phase II SI, 1998, and PKC RASR, 2000*) that were conducted pursuant to the objectives outlined above. The more recent investigative activities provide the additional data necessary to proceed with a containment design acceptable to the Department for RASR confirmation and characterization purposes. This investigation was limited to:

1. Continuation of the Vibrocore boring and media sampling program within the PKC to determine the horizontal extent of clay and till layers which are found to start approximately 27 feet below ground surface. This work ultimately included the installation of 76 Vibrocore borings in the PKC.
2. Vibrocore sampling of the lower clay-till in the PKC and analysis for permeability at selected locations.
3. Combined Hollow Stem Auger - Mud Rotary drilling with sealed casings to advance land borings outside and adjacent to the PKC. This work included 11 locations. In each boring, split spoon samples were collected at continuous 2-foot intervals or Shelby tube samples were collected from the clay.
4. Physical sampling was also conducted of the lower clay layer outside of the PKC for laboratory permeability analysis.

Additional "at risk" tasks were developed and performed based on field conditions as the program progressed. These tasks included:

1. Determination of till soil density till and analysis of select reconstituted samples for permeability.
2. Field falling head permeability tests were conducted at selected boring locations.

2.0 BACKGROUND

2.1 Previous Investigations

In the summer of 1993, the U.S. Coast Guard directed that free-phase product seepage control measures be implemented at the mouth of the Platty Kill Canal (at the Kill Van Kull) when sheens were observed in the Kill. Bayonne Industries, unsure of the specific circumstances, undertook some interim remedial actions (IRA) as outlined in an April 1994 IRA Work Plan approved by the NJDEP. The interim actions included the reconstruction of a portion of the bulkhead, a Phase I investigation to characterize sediments in the Platty Kill Canal, the installation of a subsurface free-product retainage curtain along the Kill Van Kull, and the installation of an Air-Guard™ containment system to prevent migration of free-product sheen into the Kill Van Kull main stream from BI waters.

In the fall of 1994, ENSR Consulting and Engineering (ENSR) conducted a sediment investigation of the canal as part of the Platty Kill Creek Interim Remedial Action. That investigation included the collection and analysis of sediment samples from 16 locations. The locations included eight outside of the sheet pile dam toward the Kill Van Kull; four inside of the sheet pile dam between the dam and the pipe bridge; and four locations north of the pipe bridge toward the Platty Kill Pond. Those results were reported to the Department in November 1995, in the report entitled Platty Kill Pond Interim Remedial Action Report Vols. 1 and 2.

In 1996, BI submitted a Phase 2 Sediment Investigation Work plan for the canal to the Department, Bureau of State Case Management (BSCM) for review and approval. The plan was developed based on discussions between the Department and Dr. Robert Weaver, Corporate Technical Director, BI, and was responsive to NJDEP's March 27, 1996, comments to the aforementioned Platty Kill Creek Interim Remedial Action Report, dated November 1995. Fieldwork included the collection and analysis of twenty-nine sediment core samples from eleven locations within the canal. These include seven locations in the canal between the sheet pile dam and the bridge at the northern section of the canal; and, four locations north of the bridge toward the Platty Kill Pond.

In March 1998 BI submitted a PKC Phase II Sediment Investigation Report to the NJDEP. The report provided a delineation of the impacted sediments in the canal inside of the sheet pile dam. The Department in a letter dated June 16, 1998 approved the report. In December of 1999, the Department requested that a joint RASR be developed by BI and ExxonMobil to develop the PKC impacts. The RASR was completed and submitted to the Department on February 18, 2000. The Department conditionally approved the RASR on July 13, 2000.

Additional engineering requirements and data gaps leading to the RIWA were first addressed in a letter from BI to the Department on August 31, 2000. This report documents the findings of one necessary component of the confirmatory work.

On April 11, 2000 a "hot spot" definition of the most impacted sediments in the PKC was finalized and submitted. This definition will be incorporated into the RAWP. Additional tasks identified in the August 31, 2000 letter and the recommendation section will be implemented upon the department's concurrence with the necessary tasks.

2.2 Historical Overview

The Bayonne Industries, Inc. (BI) site is a bulk liquid petroleum storage facility located in the Constable Hook area of Bayonne, Hudson County, New Jersey. Prior to 1956, the site was part of the larger configuration of a Tidewater Oil Company refinery operation, which began in the 1870's. From the 1870's to approximately 1956, the site operated as a major petroleum refinery. Refinery operations ceased in approximately 1956; from that time forward, the site operated as a bulk storage terminal.

The land adjoining the eastern and northerly runs of the PKC is currently owned by ExxonMobil and was acquired in several stages by their predecessor (Standard Oil of New Jersey) between the late 1890s and late 1930s. Between the early 1900s and 1950s, various wax manufacturing facilities had been operated and then dismantled in this section of the facility. As late as 1967, limited equipment associated with lube oil manufacturing remained in use (Dan Raviv, 1994). East of the canal, ASTs are currently used to store various lube and petroleum products.

The Platty Kill Canal is an inactive barge slip surrounded by an artificially filled industrial land site. It is approximately 1000 feet in length and is separated from the Kill van Kull by a steel sheet pile dam that was installed in 1991 under permit by the U.S. Corps of Engineers. The sheet pile dam provides a physical barrier spanning the width of the canal and acts as a restraint for sediment migration.

2.3 Physical Setting

The BI and EM sites are located within a heavily industrialized area on the east side of the city of Bayonne, in Hudson County, New Jersey, in an area often referred to as the Constable Hook. The two facilities are bordered to the north by East 22nd Street and the city of Bayonne; to the west by the Coastal Oil Co. petroleum terminal, to the south by the Kill van Kull and to the east by the upper New York Bay.

A detailed site plan for the canal area developed from a land survey for the work reported herein is included as Figure 1. Figure 1 also includes a site location map with a 1-mile radius of

the area, prepared from the U.S. Geological Survey 7.5-Minute Jersey City Quadrangle. This map shows the current site boundaries, local topography, general surface water drainage, and general land use patterns.

2.4 Site Physiography, Geology and Hydrogeology

The Bayonne Industries site is geologically located near the boundary between the Triassic Lowland and Manhattan Prong structural regions of the Piedmont Physiographic Province of New Jersey. The site is underlain by a stratigraphic sequence including unconsolidated sands, silts, and clays of Recent and Pleistocene age, and consolidated and weathered bedrock of Triassic and Precambrian age (Eckenfelder, Inc., 1992). Within the general vicinity of the site, two distinct bedrock groups have been recognized: the Newark Supergroup of Triassic/Jurassic age, and the Manhattan Schist of Precambrian to Cambrian age (Lyttle and Epstein, 1987). The Manhattan Schist is a dark gray, micaceous schist or layered gneiss with subordinate metaquartzite, metagraywacke, and amphibolite (Lyttle and Epstein, 1987; Soren, 1988).

The contact between the Stockton and Lockatong Formations of the Newark Supergroup (Lyttle and Epstein, 1987) within the Newark Basin exists in the area of the Bayonne Industries site. The Stockton Formation generally consists of sandstone, mudstone, and siltstone. Overlying the Stockton Formation is the Lockatong Formation, which consists of finer-grained, more argillaceous mudstone and siltstone.

Unconsolidated glacial and post-glacial sediments of late Wisconsinian age overlay the bedrock in this area. Glacial sediments consist of glacial till made up of varying materials and glacial outwash sediments. Proglacial lakes were formed in the area by the damming of melt waters by the Woodfordian Terminal Moraine. This glacial event provided for the deposition of lacustrine clays on lake bottoms that have been identified during this investigation. The clays near the mouth of the canal show erosional features and are mixed with gravel till. The placement of these erosional clays and till is supported by observations made in the literature. In 1902, Rollin D. Salisbury the state geologist wrote the "Kill Van Kull is not so wide or so deep as to make it unreasonable to suppose that it is of post-glacial development, and perhaps the same may be said for the Narrows and East River".

Above the glacial materials are post-glacial sediments that include recent sand, silt, and clay; some of this clay is commonly termed "meadow mat." The most recent silt and gray clay are reportedly of marine origin deposited during the later recessional period of the Wisconsin glaciation (Lueder, Obear, Holman, Rogers, 1952). Fill materials used to reclaim the area for industrial use now overlie the meadow mat gray clay. An upper, often brackish water-bearing zone exists within the fill materials.

Vibrocore and land borings performed during this investigation confirm the geology as

reported in the literature. The general profile found within the canal consists of a layer of sludge and sediment; followed by a sand, gravel, cobble layer overlying a reddish-brown clay or gravel-clay-till deposit that has been confirmed to line the bottom of the canal. Soil Boring Logs are included as Appendix A.

The layer of sludge and sediment in the canal generally ranges from 10 to 15 feet thick followed by a 1 to 5 foot thick layer composed of sand, gravel or cobbles. Beneath this layer is red silty clay, which could not be fully penetrated by the vibrocore barrel. Since the vibrocore borings did not penetrate the red silty clay, the total clay thickness within the PKC is undetermined. However, based on the adjacent land delineation soil borings, the clay thickness has been measured up to 8.5 feet thick. Along the sides of the PKC, a glacial till underlies the clay. The unconsolidated overburden deposits adjacent to the canal generally consist of fill material followed by gray clay over a layer of silty sand with some gravel and a glacial clay-till formation. Vibrocore Sediment Core Logs are included as Appendix B.

The clay penetration recorded in the vibrocore borings ranged from a trace material in the tip to a maximum 7.5 feet in Vibrocore boring (VIB) 43-2. The top of the red silty clay ranged from minus 17.7 ft. below mean sea level (bmsl) to minus 24.5 ft. bmsl. The fill material ranged from 10 to 15 feet thick on the BI side to a maximum of 25 feet thick on the EM side. The gray clay ranged from 1 to 10 feet thick over a silty sand layer ranging from 2 to 10 feet thick; followed by red silty clay. The top of the red silty clay ranged from minus 14.9 ft. below mean sea level (bmsl) to minus 24.0 ft. bmsl and ranged in thickness from 0.5 ft. thick in delineation soil boring (DSB) 01 to 8.5 ft. thick in DSB-09. There was no red silty clay found in land Delineation Soil Boring DSB-11. This is depicted on Figures 2 and 4.

On land, the underlying glacial till ranged from minus 15.4 ft. bmsl to minus 29.3 ft. bmsl and ranged in thickness from 0.5 ft. thick in DSB-04 to 6.0 ft. thick in DSB-02. However, the borings were not designed to penetrate a third confining layer (till), so the actual thickness of underlying till is undetermined.

In summary, this geology is likely the result of glacial outwash deposits and the erosional and depositional environment associated with drainage and stream flow after the retreat of the glacier. An overlay of the historic shoreline is presented in Figure 4.

Groundwater flow direction beneath the site has previously been determined to be easterly toward the canal and the Kill van Kull, the primary area of groundwater discharge in the region. This direction of the groundwater flow was confirmed on contour maps developed from groundwater elevation measurements collected by BI and Parsons for ExxonMobil. The site, located adjacent to the Kill van Kull, is tidally influenced as observed during various water level measurements collected at both sites.

3.0 TECHNICAL OVERVIEW

In preparing the RASR, the feasibility and implementability of various remedial alternatives to bring the Platty Kill Canal to closure were evaluated. Based on the evaluation and considering the data collected to date, containment and fill has been selected as the most appropriate remedy.

Investigations have been performed at both the EM and BI sites to evaluate the presence, type, extent and concentration of neighboring soil and groundwater contamination as well as the local geologic conditions. The investigation and specific work tasks addressed in this report were conducted to fill data gaps and to provide a more complete basis for consideration of containment as the most reasonable remedial alternative. The confirmed presence of the natural clay and/or till layers, with inherent low permeability, confirmed throughout approximately 78% of the canal floor length supports the containment alternative. It is only for a relatively limited area (15%) located mid-canal that a clay layer has not at yet been identified, due in part to the inability of the sampling technique (vibrocore) to penetrate a silty-sand layer present in the same area. Complete delineation of the clay, using tripod mounted conventional drilling techniques on a small barge, is proposed in the following sections of this report.

This investigation also confirmed the existence of obstructions in distinct areas of the canal (likely due to the existing deteriorating bulkhead and previous structures that may have fallen into the waterway). These obstructions are significant but are not considered limiting to the implementation of the remedy, as there is every indication that they can be removed prior to beginning construction of the containment structures.

3.1 Feasibility and Implementability Considerations

The over water vibrocore boring programs conducted in March 2000 and January 2001 did for the most part confirm the presence of clay and clay-gravel glacial till layers throughout the site and identified specific depths and aerial extent of these layers. Permeability test results on the confirmed clay samples were found to be in the 10^{-7} cm/sec range. The area lacking this specific information (mid-canal) warrants further investigation to obtain data that are more complete for both pile driving and permeability considerations.

The results of the soil boring investigations provided the data necessary to support the proposed remedy of installing a sheet pile containment barrier along the interior perimeter of the canal. A more detailed understanding of the central portion of the PKC and confirmation that this area can be addressed with a modified approach is necessary. The presence of various man-made obstructions that could impact the installation of the sheet pile does need to be evaluated in more detail.

4.0 SUMMARY OF FIELD ACTIVITIES

Bluestone performed additional investigation activities regarding the physical setting, canal construction, soils and hydrogeologic characteristics relevant to the canal closure. Detailed descriptions and results of these investigations are presented in the following sections. A site plan with the vibrocore boring, land boring and cross-section locations is presented as Figure 1. Generalized cross-sections are presented in Figure 2. An obstruction area map is presented as Figure 3 and a clay thickness and delineation map with the historic shoreline overlay is presented as Figure 4. A top of clay-till contour map is presented as Figure 5.

4.1 March 2000 Vibrocore Boring Program

Vibrocore sampling provides an efficient means to investigate vertical profiles of underwater sediments and soils. Field trials implemented in the PKC had proven that approximately three feet of the local clay-till material could be penetrated with this method. Vibrocore samples are intact columns of sediment four inches in diameter and up to 20 feet long. Collecting them requires a suitable platform for extracting and lifting the heavy cores. For that reason, this equipment has been deployed from a crane, thereby alleviating the need to work over the PKC on a platform. The crane method reduced health and safety concerns, land decontamination, and many other limitations associated with floating platform activities.

In March 2000, representative samples of the clay-till were collected using vibrocore technology. The technique was previously approved by the Department for use in sampling the PKC in 1996 and again in September 1999. The findings were submitted in the BI April 27, 2000 Quarterly Report and detailed lab data was provided to the Department at their request on August 2, 2000.

Eight clay samples were collected during the sampling activity and four were submitted to the laboratory for permeability analysis, particle size distribution and Atterberg limits. Vibrocore samples were collected near the mouth of the PKC, upstream of the existing sheet pile dam. Vibrocore sampling confirmed the location of a red-brown clay-gravel till at a depth of approximately 26-feet below the top of the western bulkhead at its southern end or approximately 18 ft. below mean sea level (bmsl). Generally, this till material at the end of the Canal was found to have higher gravel content than the clay till under the Platty Kill Pond and northern portion of the PKC.

The very dense nature of the samples and the coarse gravel (3/4 to 3 inches) in the clay matrix did not allow for the gathering of "undisturbed" samples needed for a flexible wall permeability test (ASTM D: 5084). Other routine classification tests were conducted on the soils in an attempt to make a generalized assessment of the range of permeability that this material would exhibit. A grain-size analysis (ASTM D: 422) and Atterberg limits (ASTM D: 4318) were performed on each sample. Gravel content ranged from 44.4% to 8.4% and the fines content

ranged from 62.6% to 21.1% in the samples. The testing also indicated that the soil was cohesive and exhibited plasticity. Based on these results and visual assessment, the soil was classified as a very dense, clayey glacial till.

The geotechnical laboratory concluded that based on the information referenced above and their experience with similar materials, the soil could possess a permeability ranging from 1.0×10^{-6} cm/sec to 1.0×10^{-8} cm/sec. This information confirmed the expectation that a reasonable barrier is located below the PKC and that limited additional investigation should provide a suitably complete assessment of the adequacy of the existing materials.

4.2 January 2001 Vibrocore Boring Program

In January 2001, representative samples of the clay-till were collected using vibrocore technology as discussed in the previous section. 76 Vibrocore borings were advanced in 38 locations in order to delineate potential obstructions and identify the sediment stratigraphy, especially the presence or absence of a confining clay layer of low permeability at the bottom of the PKC.

The vibrocore boring programs confirmed the presence of an impermeable clay - glacial till layer throughout the site except in an approximate 300-foot section (280 feet long) along the EM side between VIB-16 and VIB-11 and in an approximate 100-foot side (70 feet) along the BI side between VIB-37 and VIB-39 where the vibrocore could not penetrate the upper sediments. A discussion of the findings is included in the following sections.

Samples from VIB-10-1, VIB-17-2 and VIB-49-2 locations were submitted to the geotechnical laboratory (Paulus, Sokolowski and Sartor in Warren, NJ) for permeability analysis. The permeability test results ranged from 2.46×10^{-7} to 5.64×10^{-7} cm/sec and the results are summarized on Table 1. The Permeability Test Result Sheets are provided in Appendix C. A discussion of the findings is included in the following sections.

4.3 January 2001 Delineation Soil Boring Program

In the November 15, 2000, and December 28, 2000, NJDEP Comment letters regarding the Remedial Investigation for Clay-Till Sampling (dated 30 August 2000), the Department outlined the approved drilling and sampling procedure to be followed during the clay-till delineation and associated Shelby tube sampling. This was followed up by a comment letter from BI dated January 3, 2001. The drilling program required setting casings into the confining units prior to advancing the drilling into the underlying formations.

As noted earlier, the delineation soil-boring program confirmed the presence of an impermeable clay-glacial till layer throughout the site except in an approximate 300-foot section (330 feet long) along the EM side between DSB-6 and DSB-4. The only boring that did not

contain the relatively impermeable clay-glacial till layer was DSB-11. This boring defined a silty sand overlying the till.

The program thus determined that a distinct layer of red-brown clay extends along the northern portion of the PKC. This clay was first thought to be a clay-till (i.e., moved by glacial ice) with less gravel north and more gravel to the south near the mouth of the PKC. However, a formation contact was found in the northern portion of the PKC where a clay layer rests on the underlying clay-till.

Under the southern portion of the PKC, the clay is mixed with gravel and maintains a relatively low permeability. Here it is thought to be a clay-till or an erosional lacustrine clay and till mixed where the PKC drained into the Kill Van Kull.

Landside soil borings performed during the investigation also confirmed the glacial geology as reported in the literature. The unconsolidated overburden deposits adjacent to the canal generally consist of fill material overlying gray clay that was deposited over a layer of silty sand with some gravel and finally red-brown glacial clay and clay-till formations. This profile is likely the result of glacial outwash deposits and the erosional and depositional environment associated with drainage and stream flow after the retreat of the glacier.

The fill material ranged from 10 to 15 feet thick on the BI side to a maximum of 25 feet thick on the EM side. The gray clay ranged from 1 to 10 feet thick over a silty sand layer ranging from 2 to 10 feet thick; followed by red silty clay. The top of the red silty clay ranged from 14.9 ft. bmsl to 24.0 ft. bmsl and ranged in thickness from 0.5 ft. thick in DSB-01 to 8.5 ft. thick in DSB-09. There was no red silty clay noted in DSB-11. The underlying glacial till ranged from 15.4 ft. bmsl to 29.3 ft. bmsl and ranged in thickness from 0.5 ft. thick in DSB-04 to 6.0 ft. thick in DSB-02. However, the borings were not designed to penetrate a third confining layer (the till), so actual glacial till thickness below the clay remains undetermined. Detailed cross sections have been prepared and are presented on Figure 2.

4.4 Laboratory Permeability Testing

Laboratory permeability testing was performed on four successful Shelby Tube samples collected from eleven borings and three selected vibrocore samples. Two additional samples of the clay-till were analyzed after they were reconstituted. Shelby Tube sample collection was attempted at each boring location but was not always successful. Samples were difficult and impossible to collect where the clay was less than three feet thick. The procedure of sealing the casing 1-foot into the clay and pushing the Shelby Tube the additional two feet required a minimum of 3-feet of clay.

Shelby Tube and vibrocore boring soil samples of the clay-till materials were collected and submitted to Paulus, Sokolowski and Sartor of Warren, NJ, to perform permeability tests

according to ASTM standards. Laboratory constant head permeability testing was performed on a total of seven (7) samples collected during the vibrocore and delineation soil boring programs. The laboratory Permeability Test Result Sheets are provided in Appendix C, laboratory Undisturbed Sample Logs of the Shelby tubes are included in Appendix D. Vibrocore Logs completed by the laboratory are included in Appendix E.

To investigate the permeability differences between the clay and clay-till, a sample was collected below the clay in the till with a split-spoon sampler at DSB-07 from 37 to 38 feet below ground surface. This sample was sent to the laboratory and its density was measured to be used in reconstituting it for a falling head permeability test. A second, disturbed sample from DSB-03 (36 to 38 ft. bgs) was reconstituted to the same density and a second falling head test was conducted in the laboratory. The results of the reconstituted samples from DSB-07 and DSB-03 were 5.05×10^{-6} to 2.17×10^{-6} cm/sec respectively. Logs of these materials are included in Appendix D.

In summary, permeability test results from successful Shelby Tubes clay samples ranged from 1.47×10^{-7} to 8.80×10^{-7} cm/sec and 2.17×10^{-6} to 5.05×10^{-6} cm/sec for the reconstituted clay-till samples. The results are summarized on Table 1.

4.5 Field Falling Head Permeability Testing

At the end of the boring program field falling head permeability tests were performed in three (3) borings where soil samples could not be collected. The time period between obtaining the final Shelby Tube samples and the grouting of the last borings provided an ideal opportunity to perform these field tests and to attempt to correlate the field observations with the laboratory generated data. The Field Falling Head Permeability Test was performed in the field for DSB-04, DSB-10 and DSB-11. The tests were performed according to the methodology and calculations contained in Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, Corps of Engineers, US Army, April, 1951.

Permeability test results ranged from 2.8×10^{-3} to 1.5×10^{-6} cm/sec and the results are summarized on Table 1. The boring DSB-11 that did not contain the impermeable clay-glacial till layer also had the highest permeability result calculated at 2.8×10^{-3} cm/sec.

The results of the field permeability tests for DSB-04 (6.3×10^{-5} cm/sec at 36.0 feet depth) and DSB-10 (1.5×10^{-6} cm/sec at 34.0 feet depth) did not correlate well with the more controlled laboratory results. The laboratory permeability result for DSB-10 analyzed from a Shelby Tube sample collected from 29.5 ft. to 30.0 ft. depth below surface is calculated at 6.87×10^{-7} cm/sec; as compared with the field result of 6.3×10^{-5} cm/sec. obtained at 34.0 feet.

There was no red silty clay noted in DSB-11 and the material could not be sampled with a

Shelby Tube for laboratory permeability testing. Field permeability was calculated from the DSB-11 sample collected at 38.0 feet depth as 2.8×10^{-3} cm/sec. However, considering the possibility for casing leakage during the test and a comparison to the better-controlled laboratory results, the field findings may be considered biased high. Observations of the material do indicate that it is more permeable than the clay-till formation. This variation in permeability between DSB's - 04 and -10 versus DSB-11 is likely attributed to a facies change in the area of boring DSB-11. This apparent change merits future investigation and is discussed further in Section 6, Recommendations.

4.6 Surveying

All sampling locations were surveyed by a certified Professional Land Surveyor, J. Peter Borbas, PLS, Boonton, New Jersey. Horizontal locations were determined from USGS control points set on site. Vertical elevations were determined using the North American Vertical Datum 1929 (NAVD 29). The latitude and longitude of each boring location is provided on the boring log.

All vibrocore boring locations were marked on the bulkhead with nails and orange flagging. An offset distance from the face of the bulkhead perpendicular to the boring location in the canal was measured with a Leica laser or estimated using a measuring tape when severe weather conditions were encountered.

5.0 FINDINGS AND RESULTS

5.1 Geological Conditions

There is a close connection between the environment of deposition of natural sediments underlying the PKC site and the hydrogeologic characteristics of the sediments. Based on the environment of depositions identified by Carswell and others for the area, and the anticipated flow regime, the underlying lacustrine clays and glacial till provide two levels of physical confinement for the containment remedy developed in the RASR.

This program confirmed the glacial geology as generally reported in the literature. The general soil profile within the canal area consists of a layer of sludge and sediment; followed by a sand, gravel, cobble layer overlying a reddish-brown clay and/or gravel-clay till. These deposits have been confirmed to line the bottom of most of the canal. The exception to this is an area at the mid point where the vibrocore could not penetrate and where on the eastern landside clay was not found. The unconsolidated overburden deposits adjacent to the canal generally consist of fill material over a layer of silty sand with some gravel and a glacial clay-till formation.

This profile is likely the result of glacial outwash deposits and glacial lake development followed by the erosional and depositional environment associated with drainage and stream flow after the retreat of the glacier. This is supported by the outline of the historic (pre-land filling) creek and river shoreline and drainage depicted on Figure 4. The only boring that did not confirm the presence of the clay-glacial till layer was DSB-11. This area may have undergone erosion by the Kill van Kull during an early glacial retreat and formation of the Kill. A clay-till thickness is also presented on Figure 4. The top elevation of the clay and clay-till is contoured and presented as Figure 5.

The layer of sludge and sediment in the canal ranged generally from 10 to 15 feet thick followed by a 1 to 5 feet thick layer of sand and gravel or cobbles. Beneath this layer, red-brown silty clay was encountered which could not be fully penetrated by the vibrocore barrel. The clay penetration recorded in the vibrocore borings ranged from a minimal trace material in the tip of (VIB 20-1, 24-1, and 35-1) to a maximum 7.5 feet in VIB-43-2. The top of the red silty clay ranged from 17.7 ft. bmsl to 24.5 ft. bmsl.

5.2 Known Canal Obstructions

Obstructions noted on the Obstruction Area Map (Figure 3) were located based on the visual condition of the bulkhead as well as the ability of the vibrocore barrel to penetrate the sediments. As noted on the map, there are two sections of dilapidated and collapsed bulkhead, both located in the upper reaches of the canal near the pond. In these areas, it is likely that the bulkhead and collapsed remnants will have either to be removed or restored prior to sheet pile installation. There is another fairly large obstructed area in the vicinity of VIB-36 and VIB-51

that appears to extend into the center of the canal. In the early 1980's, the bulkhead on the EM side collapsed and was subsequently restored. It is possible that these obstructions are a remnant from that time period.

5.3 Permeability Results

The laboratory permeability test results range from 2.17×10^{-6} to 8.80×10^{-7} cm/sec indicating that the clay and clay-till serves as a relatively impermeable barrier to the vertical migration of contaminants. Where both are present the barrier is clearly a viable one compatible with a long-term containment-based remedy. In locations where only the clay-till is present, the barrier is acceptable with an artificial reduction in the peziometric head inside the barrier. Where sandy silt has been found, further investigation is warranted to quantify the permeability and to develop a responsive action plan.

5.4 Field Falling Head Permeability Tests Results

The results of the field permeability tests for DSB-04 (6.3×10^{-5} cm/sec at 36.0 feet depth) and DSB-10 (1.5×10^{-6} cm/sec at 34.0 feet depth) indicate that the canal floor serves as a relatively impermeable barrier to the vertical migration of contaminants. The laboratory permeability result for DSB-10 analyzed from a Shelby Tube sample collected from 29.5 ft. to 30.0 ft. depth below surface is calculated at 6.87×10^{-7} cm/sec; which loosely correlates with the field result of 6.3×10^{-5} cm/sec. obtained at 34.0 feet.

The variation in permeability between DSB's -04 and -10 versus DSB-11 merits future investigation and is discussed further in Section 6, Recommendations.

5.5 Summary Of Findings

Based on the results of the sediment investigations conducted on the Platty Kill Canal, the following can be generally concluded:

1. The vibrocore boring programs conducted over water in March 2000 and January 2001 confirmed the presence of clay and glacial till layers throughout the PKC except in an area where the vibrocore could not penetrate the upper sediments to the depth where the clay was otherwise found (approximately -15 ft below top of sediments or -29 ft below top of bulkhead). An area approximately 300-foot long on the EM side between VIB-16 and VIB-11 and approximately 100-foot long along the BI side between VIB-37 and VIB-39 remains where the clay needs to be confirmed.
2. The land soil boring delineation program conducted in January 2001 confirmed the presence of a clay and underlying clay-till layer throughout the site except in one boring, DSB-11.

Based on distance between DSB-11 and DSB-6 and between DSB-11 and DSB-4, a length of approximately 300-feet along the EM side remains where the clay has not yet been defined.

3. Permeability test results on the four (4) clay and till samples collected from the delineation soil borings ranged from 1.47×10^{-7} to 8.80×10^{-7} cm/sec.
4. Permeability test results on the three (3) clay and till samples collected from the vibrocore borings ranged from 2.46×10^{-7} to 5.64×10^{-7} cm/sec.
5. The results of the field observations and the laboratory permeability analyses have demonstrated that the clay and clay-till "canal floor" serves as an impermeable barrier that is effective in retarding the vertical migration of contaminants.
6. Obstructions were identified in selected areas of the PKC and some are large enough to warrant further investigation. The obstructions are not expected to be so large as to require modification of the selected remedy.

6.0 RECOMMENDATIONS

This section proposes additional forward engineering and investigation activities to supplement the existing information in support of a Remedial Action Work Plan to bring the Platty Kill Canal remediation effort to an acceptable closure.

1. Utilize a drilling tripod mounted on a floating platform to complete the delineation borings within the area shown on Figure 4 where the clay needs to be confirmed. Drive and wash drilling method will be used along with continuous 2-foot interval split spoon sampling. This is necessary to delineate more precisely the area where the clay layer might not be under the silt. This area is not expected to be as large as currently defined based on the spacing of the borings.

The borings locations will be VIB-11 through VIB-16, VIB-38, 39, and 50 as shown on the figures. The "Remedial Investigation Addendum for Sampling Clay-Till", August 2000, will be followed using the "Conventional Drilling Soil Sampling Procedure" included in the Quality Assurance Project Plan, March, 1999" developed for the BI site.

2. Perform additional land borings if necessary to determine the thickness of the confining clay-glacial till unit, as might be required for engineering and/or hydrogeologic reasons.
3. Delineation and identify obstructions in the field in both the canal and the adjacent bulkhead and land areas for budgetary and engineering purposes.

The delineation work listed above is weather dependant and cannot be safely conducted in the winter season. A proposed schedule for the work is included for Department approval.

7.0 SCHEDULE

The following is a proposed schedule of implementation of the work plan addendum tasks. These tasks will be initiated after the review and approval by the NJDEP.

PLATTY KILL CANAL IMPLEMENTATION SCHEDULE

7.0 PLATTY KILL CANAL IMPLEMENTATION SCHEDULE

The Following is a proposed schedule of implementation of the work plan addendum tasks. These tasks will be initiated after the review and approval by the NJDEP.

TASKS	YEAR	2001												2002											
	MONTH	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Clay-Till and Obstruction Investigation																									
Prepare RI Addendum Report																									
Submit RI Addendum Report to NJDEP																									
NJDEP Review and Approval																									
Phase 2 Clay Investigation and Delineation (Field)																									
RASR Feasibility Confirmation																									
Prepare RI Findings Addendum Report																									
Submit Phase 2 RI Addendum Report to NJDEP																									
NJDEP Review																									
Pre-application Permit meeting(s)																									
Permit identification																									
Remedial Action Workplan Preparation																									
NJDEP REVIEW																									

NOTE: Schedule contingent upon 60 day NJDEP reviews

8.0 CERTIFICATIONS

Following are the certifications as required by the Department in order to constitute a complete submittal.

8.0 CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true.



R.R. Fisette

Vice President
Bayonne Industries Inc.

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Certifications

Submission: Platty Kill Canal Remedial Investigation Addendum Report

Date: August 21, 2001

General Objection

ExxonMobil objects to the certification requirement in that the requirement of certifications herein is beyond the scope of authority granted to the Department by applicable statutes and is in conflict with the pre-existing contractual provisions of the ACO executed between ExxonMobil and the Department. The certification requirement is, thus, unconstitutional. However, in light of the fact that submissions made to the Department without the certifications are deemed by the Department to be incomplete, ExxonMobil signs below subject to the proviso that ExxonMobil and the signatories hereunder reserve all rights to challenge the certification requirement in any civil or criminal enforcement proceeding.

N.J.A.C. 7:26E-1.5(a)

This submission is certified pursuant to N.J.A.C. 7:26B-1.6 and the certification is made subject to the statutory provisions of N.J.S.A. 2C:28-3(a). Because of the limitations imposed by the manner in which information is collected and summarized, there is no one person who has direct knowledge of all the information used to prepare the submission and who also has overall responsibility for all of the information contained in the submission; however, based on the above and the General Objection and my review of the information transmitted in this submission:

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, To the best of my knowledge the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of N.J.S.A. 13:1K-6 et seq., I am personally liable for the penalties set forth at N.J.S.A. 13:1K-13."

N.J.A.C. 7:26E-1.5(a)

This submission is certified pursuant to N.J.A.C. 7:26C-1.2 and the certification is made subject to the statutory provisions of N.J.S.A. 2C:28-3(a). Based on the above and the General Objection and my review of the information transmitted in this submission:

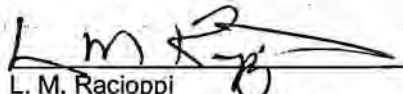
"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties."

Notarized:

Date:

8/22/01

RITA E. BECKETT
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Feb. 6, 2003


L. M. Racioppi
Area Manager - Refining/Chemical

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Tables

TABLE 1:

Laboratory Constant Head Permeability Test Results			
Sample Designation	Sample Interval (depth in feet)	Soil Description	Permeability (cm/sec)
DSB-06	30.0 to 32.0	Reddish-brown clay	2.54×10^{-7}
DSB-08	33.0 to 34.0	Reddish-brown clay	1.47×10^{-7}
DSB-09	33.0 to 35.0	Reddish-brown clay	8.80×10^{-7}
DSB-10	29.5 to 30.0	Reddish-brown silt w/clay	6.87×10^{-7}
VIB-10-1	33.0	Red plastic silty clay	2.46×10^{-7}
VIB-17-2	33.5 to 35.0	Red plastic silty clay	5.20×10^{-7}
VIB-49-2	30.0	Red plastic silty clay	5.64×10^{-7}

Laboratory Falling Head Permeability Test Results			
Sample Designation	Sample Interval (depth in feet)	Soil Description	Permeability (cm/sec)
DSB-03	36.0 to 38.0	Reddish-brown till	2.17×10^{-6}
DSB-07	37.0 to 38.0	Reddish-brown clay till	5.05×10^{-6}

Field Falling Head Permeability Test Results			
Sample Designation	Sample Interval (depth in feet)	Soil Description	Permeability (cm/sec)
DSB-04	36.0	Reddish-brown till	6.3×10^{-5}
DSB-10	34.0	Reddish-brown till	1.5×10^{-6}
DSB-11	38.0	Reddish-brown till	2.8×10^{-3}

Figures



State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection

Robert C. Shinn, Jr.
Commissioner

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
NO. P127 638 288

OCT 15 1999

John E. Hannig
Site Remediation Project Administrator
Exxon Company, USA
P.O. Box 728
Linden, NJ 07036

Re: Free Oil Recovery Interim Remedial Measures
Exxon Bayonne Terminal
November 27, 1991 Administrative Consent Order/Amended December 24, 1998

Dear Mr Hannig:

The Department of Environmental Protection (Department or NJDEP) has completed a review of Exxon Company's (Exxon) July 30, 1999 Draft Interim Remedial Measures (IRM) Work Plan for the implementation of a Free Oil Recovery Program (FORP) at the former Exxon Bayonne Plant (site). The Department is writing to inform you that the Draft IRM Work Plan must be revised in accordance with the Department's comments that are attached to this letter. However, the Department is granting Exxon interim approval for some of the proposed IRMs so that Exxon may move forward with the FORP while the IRM Work Plan is being revised.

Exxon has requested that the Department grant interim approvals for the installation and operation of four (4) of the free oil recovery systems being proposed in the Draft IRM Work Plan. Interim approvals for these systems would allow for their implementation to occur concurrent with Exxon responding to the attached comments and finalizing the IRM Work Plan. The four recovery systems requiring interim approvals are in the following areas: Plume 1 (Pier 7), Plume 6 (southern portion of General Tankfield), Plume 16 (Platty Kill Canal Area water table zone) and Plume 16A (Platty Kill Canal Area confined zone).

In the interest of expediting improved free oil remediation efforts at the site, NJDEP conditionally approves the construction and operation of the proposed recovery systems in these areas. This approval is subject to conformance with the attached comments. In particular, it should be noted that Plumes 1, 16 and 16A are located adjacent to surface water bodies. These plumes may require additional remedial measures should it be determined that free oil and its constituents are directly or indirectly (via surface water) impacting sensitive receptors (Critical Function #3 of the FORP).

In addition, it is clearly evident from visual observation that the Platty Kill Canal has already been impacted by contaminant discharges that include free and dissolved phased petroleum hydrocarbons. The Department has determined that Exxon is responsible for contributing to these impacts. This determination is based in part on the Department's review of reports documenting historical spills and the migration of subsurface free oil into the Platty Kill Canal (see attached comments). The Department

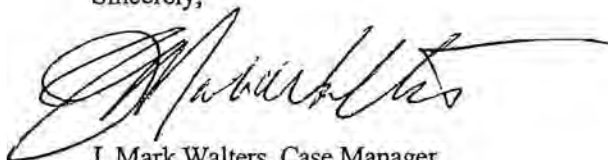
acknowledges that the remedial measures proposed for plumes 16 and 16A is an appropriate response by Exxon, which may prevent further migration of free oil to the Platty Kill. However, controlling plume migration alone will not address the surface water and sediment contamination that has already occurred. Since these contaminants can potentially migrate via surface water to other sensitive receptors, additional remedial measures are required.

Therefore, pursuant to Paragraph 76 of the ACO, Exxon is here-by required to submit to the Department a Remedial Action Selection Report (RASR) for the implementation of additional remedial measures for the Platty Kill. The RASR must comply with N.J.A.C. 7:26E-5 of the Technical Requirements for Site Remediation and be submitted to the Department within forty-five (45) calendar days from receipt of this correspondence. At a minimum, the RASR must propose remedial measures that will remove all accumulations of free oil on the banks and that will address all sediment and surface water contamination presently being detected. Please note that the remediation of the Platty Kill will be managed separately from the remedial activity associated with the FORP.

Pursuant to Paragraph 21 of the ACO, Exxon must now modify the Draft IRM Work Plan so that it incorporates the revisions specified by the Department in the attached comments and submit the revised FORP IRM Work Plan within ninety (90) calendar days after receipt of this correspondence. This may be accomplished through the use of inserts and the replacement of specific sections into the existing draft document rather than resubmitting the whole document. Should Exxon wish to meet with the Department within this time frame to discuss its comments, a "response to comments" document should be drafted first by Exxon and submitted within 14 days of the meeting. This document will be used as an agenda and where appropriate, incorporated into the revised IRM Work Plan.

If you have any questions regarding this matter or would like to schedule a meeting, please contact me at (609) 633-1486.

Sincerely,



J. Mark Walters, Case Manager
Bureau of Case Management

enclosure

cc: Robert C. Weaver, Bayonne, Industries, Inc. w/o enclosure
Anthony Kahaly, USEPA
James Monkowski, Bayonne Health Department

NJDEP Comments on the July 30, 1999

FORP Draft IRM Work Plan

I. Protection of Sensitive Receptors (Critical Function #3)

The Department has identified the protection of sensitive receptors as a critical function of the FORP. Exxon has determined that the two main pathways that may affect human and/or ecological receptors would be volatile organic movement into buildings and movement of free oil into nearby surface water bodies.

1. Building Pathways

a) A detailed inventory of all buildings on the Bayonne property must be incorporated into the overall monitoring program for the FORP. It must be determined whether the buildings have basements or other subsurface areas associated with it that may represent a risk for vapor accumulation. In addition, Exxon must canvas the buildings on surrounding properties where Exxon plumes (or vapors associated with the plumes) may potentially be migrating off-site.

b) Exxon has proposed generic methods of monitoring for each of these pathways. The monitoring techniques must be provided in more detail. For each plume, a sampling plan and monitoring timetable has to be prepared. Depending on the particulars of each plume, field-screening devices (PID, FID, etc.) may not be appropriate. In particular, plumes (or vapors associated with the plumes) that may potentially be migrating off-site will require laboratory sampling to evaluate air quality.

2. Surface Water Pathways

a) The IRM Work Plan must note that protection of sensitive ecological receptors in surface water involves not only their protection from oil sheens, but also their protection from dissolved constituents emanating from free/residual product. This applies both to dissolved constituents emanating from free product sheens floating on surface water and dissolved constituent plumes in ground water that discharge to surface water. Please note that NJDEP did not accept the exclusion of the Upper New York Bay and Kill Van Kull waterways from the investigation of ecological impacts from the site, as proposed in Exxon's February 1996 Baseline Ecological Evaluation (BEE). (See NJDEP's July 9, 1996 comment letter to Exxon on the BEE.) These waterways also receive significant impacts from the site in the form of non-aqueous phase liquid (NAPL) and

dissolved constituents emanating from free and residual NAPL. Therefore, as part of Critical Function # 3 of the FORP, Exxon shall monitor for potential ecological impacts on adjacent surface water bodies from NAPL and its dissolved constituents.

b) The IRM Work Plan must specify that additional measures to protect sensitive ecological receptors from dissolved constituents from the NAPL plumes will be proposed whenever the potential for impacts are detected. Please note that monitoring for potential impacts to nearby surface water bodies may require the installation of monitor wells to assess the ground water quality entering the surface water.

II. Progress and Performance Monitoring/Reporting

1. Performance Monitoring

a) The performance standard for the proposed NAPL remediation systems is to measurably reduce the horizontal and vertical extent of the free product plumes over time by removing recoverable oil. However, the IRM Work Plan did not provide an explicit monitoring proposal for measuring the remedial performance at each plume. Exxon must propose a monitoring plan that is capable of demonstrating whether or not the performance standard is being achieved for each plume. The proposed monitoring plan must be presented in the text and on figures depicting plume and well locations. Please note that N.J.A.C. 7:26E-4.8 requires that all figures have well locations and identifiers, as well as all data and relevant site features shown in clear, legible printing.

b) Please note that "plume fringe" wells are needed, (i.e., wells in areas in which the plume is believed to be less than 0.1 ft. in "true" thickness). The purpose of the plume fringe wells would be to monitor plume behavior as a result of the remedial activities and whether the plume is spreading or migrating over time.

c) For plumes where total fluids (oil and ground water) recovery systems are being proposed, the IRM Work Plan must state explicitly how, and how often, the recovery systems will be checked to make sure that they are recovering oil at optimal rates. This is especially critical in areas that the fluids are not being discharged to tanks where the quantity of oil can be directly measured periodically.

2. Progress Reporting Requirements

a) Under the proposed IRM Work Plan, Exxon will submit periodic construction progress reports, monitoring reports (during system operations), and performance evaluation reports. The 1991 ACO requirements stipulate the submission of a Quarterly Progress Report to recount activities conducted during

a specified three-month period and proposed future work. To avoid exponentially increasing documents being submitted from Exxon, it would make sense to incorporate the construction and monitoring reports for the IRM activities into the existing Quarterly Progress Reports. This comment is applicable to all the discussions dealing with periodic progress reports for the various plumes and proposed IRM activities.

b) The IRM Work Plan often identifies likely sources of the NAPL plumes throughout the Bayonne site. In accordance with Critical Function #1 (Systematically identify and eliminate any potential or actual uncontained releases of free oil), it may be necessary to investigate these potential sources (i.e., soil sampling). Ultimately, the entire site will be characterized during the remedial investigation (RI). However, if these areas represent a significant continual source of ground water contamination and/or (more importantly) continuous source of free oil, containment or remediation of these source areas may be needed. Until the RI commences again, interim investigations may be required to address these significant source areas pursuant to Critical Function #1. Therefore, the Progress Reports must recommend appropriate actions in this regard when it is deemed essential for Critical Function #1.

c) Exxon must periodically examine the proposed schedule for implementation of the FORP activities and evaluate the need to resume RI activities as the remediation of each plume progresses. Progress Reports must provide the results of these evaluations and recommend projected dates for beginning the RI. Such evaluations must prioritize the resumption of RI activities based on the level of risk posed to human health and the environment. Please be advised that the estimated IRM completion date for any given plume should not necessarily be the trigger date for beginning RI activities.

d) Soil and dissolved ground water contamination in areas that are not effected by the FORP (areas that free oil plumes have not been detected) may require the initiation of RI activity once IRM activities are underway. For instance, surface soil with chromium contamination and dissolved ground water contamination containing chlorinated solvents near surface water, may require the initiation of RI activities regardless of the status of the IRM activities. Therefore, the Progress Reports must address the need to begin RI activities within any other areas the site that may pose an immediate risk to human health and the environment.

e) If it is determined that any of the recovery or monitor wells are no longer required or if a well is damaged, the next consecutive Progress Report must provide a petition to NJDEP for properly abandoning the well(s). The petition must include all necessary information necessary to demonstrate to NJDEP why Exxon believes that the well is no longer needed and/or how the well has been damaged. A New Jersey licensed well driller who is certified to seal wells must perform all recovery or monitor well abandonment.

3. Performance Evaluation Reporting

Annual performance evaluation reports must be submitted for all free product remedial systems for a minimum of five years following the startup of each system. Please note that the performance evaluations of each IRM/plume should be combined into one report. Following the initial five-year period, Exxon may petition NJDEP for a reduction in the frequency of the performance evaluation reports. The purpose of this is to ensure and demonstrate that all remedial systems are operating at optimum levels and that free product will be remediated in the shortest possible time.

III. *Sewers*

1. Integration of Sewer IRM Results with RI and FORP Results

In Section 3.4.1 Exxon attempted to address a technical deficiency noted by the NJDEP by integrating the various sources of information on the Bayonne site, including RI, FORP and sewer investigation results. Soil, NAPL, ground water, and sewer integrity data, as well as historical information, when examined in the whole, may dramatically assist the ongoing investigation and ultimate remediation of contamination at the site. Exxon has endeavored to accomplish this but the most critical tool – maps – were not generated to visualize the information. The IRM Work Plan provides a summary of the data within the text. However, knowing there are, for example, 5 exceedances of the TPH 30,000 ppm levels and 2 breaks in the sewer line in the general vicinity of Plume XX does not aid in developing a conceptual model unless the visual presentation of the data is presented on a map (i.e. the sewer pipes in relation to the soil exceedances and the plume, indications of ground water flow direction in the area, etc.).

Therefore, maps must accompany Section 3.4 of the IRM Work Plan, which relate the findings of the sewer investigation to the FORP. These maps shall indicate the locations of each of the sewer-lines discussed in relation to the free product plumes at the site. In addition, the locations of the samples discussed in this section shall be indicated on the maps, with the exceedances of soil cleanup criteria and ground water quality criteria detected in the samples shown on the maps or in a separate table.

2. Soil Quality

a) Soil quality is discussed in Section 3.4.3 of the IRM Work Plan as it relates to each of the 6 Main Trunks of the Bayonne sewer line. Each of these sections discusses the results of prior soil sampling and those results that exceed some undefined criteria. This Section must be revised so that it identifies the specific criteria that are being utilized for comparison to the soil results. This comment is applicable to discussions on all 6 Main Trunks.

b) The text in Section 3.4.7 of the IRM Work Plan refers to 18 soil samples in the vicinity of Main Trunk #5 that had TPH results in excess of 30,000 mg/kg

(page 3-30). The next line refers to 8 samples in excess of 30,000 mg/kg. Please clarify this discrepancy.

IV. Plume-Specific Requirements

1. Lengths of Operation of Recovery Systems

Many of the projected recovery system operation times are very long. For example, 31 years is projected for Plume 16, 34 years is projected for Plume 14A, and 35 years is projected for Plumes 8 and 9. One of the main goals of the FORP is to remediate free product at the site as expeditiously as possible. Therefore, the IRM Work Plan must discuss whether up-front use of alternative technologies or system modifications, such as closer recovery well spacing, might shorten the time needed for remediating these plumes.

2. Plume 1

The proposal for quarterly monitoring states that only the volume of total fluids pumped from the Sheri 3 system will be reported. The IRM Work Plan needs to specify that the volume of oil recovered (from the total fluids) will also be reported.

(Please note that NJDEP Comment I.2 above will apply to this plume.)

3. Plumes 2 and 3

The passive recovery system proposed in this area does not address migration of dissolved constituents to Upper New York Bay. Critical Function 3 of the FORP must be addressed for this plume.

4. Plume 4

a) Please begin quarterly and annual reporting on the progress of free product recovery at Plume 4, beginning with the fourth quarter of 1999.

b) Please clarify how it was determined that a competent red shale and sandstone occurs beneath this area at a depth of 20-50 ft. Geologic cross-sections in the 1995 Phase IA RI Report seem to contradict this finding. It is known from review of historic borings performed at the site that some intervals in the till underlying the site contain large boulders. Please confirm whether or not boulders may have been mistaken for competent bedrock.

5. Plumes 8 and 9

a) The IRM Work Plan must discuss whether or not modifications to the proposed system design, such as the closer spacing of recovery wells, would significantly reduce the time for remediation of free product to be completed in

this area. Furthermore, the IRM Work Plan must provide justification for not selecting other remedial alternatives that would result in better recovery of free oil in the plume.

b) Oil recovered from the proposed trench and recovery wells will be pumped to the West Side Treatment Plant via the existing sewer lines. The IRM Work Plan must provide a plan for verifying the integrity of the specific sewer lines to be utilized in this remedial action.

6. Plume 10

Plume 10 represents a potential health risk to human receptors in off-site facilities due to volatile vapors. Based upon the levels of ground water contamination present and the proximity of subsurface utilities and/or basements, Exxon shall canvass the immediate off-site area, locate all subsurface utilities and basements, and determine the presence/absence of gasoline vapors in accordance with N.J.A.C. 7:26E-4.4(h) 3.viii. Exxon shall plot the exact locations of all subsurface utilities and basements on a **scaled** site map. If it is confirmed that the source of the vapors is emanating from the Exxon site, Exxon shall take immediate action to abate and remediate the source in accordance with N.J.A.C. 7:26E-1.11. These activities shall be conducted as soon as possible.

7. Plumes 11 & 12

Monitor Well MW19 located north of the trench must be included in the monitoring program for these plumes. Additional delineation/IRM may be required should the free oil detected in this well be unaffected by the proposed IRM for these plumes.

8. Plume 14-A and 14-B

Oil recovered from the proposed trench and recovery wells will be pumped to the West Side Treatment Plant via the existing sewer lines. The IRM Work Plan must provide a plan for verifying the integrity of the specific sewer lines to be utilized in this remedial action.

9. Plumes 16 and 16A

a) Please note that NJDEP did not accept the conclusions of the December 14, 1994 NAPL IRM Investigation Report of the Platty Kill Canal Area (Raviv Report), which states that there is no evidence to relate any NAPL discharge from this IRM area to the Platty Kill Canal. (Please see NJDEP's March 8, 1995 review letter to Exxon.) Both the confined and unconfined free product plumes are located adjacent to the canal. The bulkhead along the canal is wooden and 47 years old, and its depth and condition were not evaluated. The viscosity's of product present within both product plumes are considered recoverable, and therefore, mobile. Furthermore, the fill and sediment types in these plumes would

not prevent migration of product from these plumes to the canal. It should also be pointed out that the Raviv Report did not address the migration of dissolved constituents to the canal. Therefore, in addition to the proposed IRM for these plumes a separate proposal for the remediation of existing impacts to the Platty Kill is required (see cover letter to these comments).

b) NJDEP does not consider the size of the plume alone sufficient reason to increase the spacing of recovery wells to double that recommended for skimming. This is particularly so, since the increased recovery well spacing may be partly responsible for the long projected time of operation of the recovery systems in these plumes (31 years). Therefore the IRM Work Plan must discuss whether or not modifications to the proposed system design, such as the closer spacing of recovery wells, would significantly reduce the time for required for remediating free oil in this area.

(Please note that NJDEP Comment I.2 above will apply to these plumes.)

10. "Outlier" Plume (Southeast of Plume 16)

No plans for a system in this area are included in the IRM Work Plan. The IRM Work Plan must address this plume.

V. Appendices

1. Appendix A, QAPP

It is stated in the beginning of the QAPP that the information provided in the QAPP is based on EPA guidelines. Please be advised that QAPPs for work performed under NJDEP Site Remediation Program must comply with N.J.A.C. 7:26E-2.1 and 2.2.

2. Appendix B, Standard Operating Procedures (SOPs) Temporary Well Installation

a) This SOP references NJDEP's July 26, 1996 letter, which amends the protocol for temporary well installations described in Method No. 3 of the NJDEP Alternate Ground Water sampling Techniques Guide. A copy of Department's July letter was not attached to the SOP. This letter must be attached as part of the SOP.

b) The procedure for obtaining blanket boring permits for the installation of temporary wells needs to be corrected to indicate that blanket boring permits are to be obtained from NJDEP's Bureau of Water Allocation, not from municipalities or property owners. When borings or temporary wells are to be installed on properties owned by separate owners or installed in more than one municipality, separate blanket boring permits are needed. (One for each municipality and one for each of the differently owned properties.)

- c) The method for the measurement of NAPL thickness must be provided in procedure 15.
- d) This SOP must include a section on driving the wellpoint to the target depth, below the depth of the drilled borehole.
- e) This SOP shall include instructions for documentation of temporary well abandonment, per NJDEP's 7/26/96 letter.

3. Appendix B, SOP for Permanent Well Installation

- a) This SOP must be revised in accordance with the comments below, N.J.A.C. 7:26E-4.4(g) and the New Jersey Monitor Well Requirements in Appendix 7-1 of NJDEP's Field Sampling Procedures Manual (FSPM) (May 1992).
- b) Please note that NJDEP's Monitor Well Requirements (revised 3/92) no longer specifies the use of a layer of bentonite pellets or chips above the sandpack. Therefore, the SOP must provide for a layer (minimum 2 ft.) of #00 sand to be placed above the sandpack to prevent infiltration of grout into the sandpack. An NJDEP-approved grout (per Tables 1 through 3 in Appendix 7-1 of FSPM) must be placed by pumping through a tremie pipe in one continuous operation, from the top of the fine sand layer to the depth at which the cement collar is to be emplaced (about 3 ft. below grade). The grout must be checked for settling after 24 hours and topped off, if necessary. The tremie pipe should discharge to the side.
- c) The SOP must indicate (Per the FSPM) that well development will take place no less than 14 days prior to ground water monitoring activities, to allow the ground water to stabilize.

4. Appendix B, SOP for Monitor well Development

- a) This SOP must provide for the removal of all water lost to the formation during drilling, and the removal of all fines that may have accumulated within the well, as well as those that may have been smeared on the inside of the borehole during well drilling.
- b) The well development log must include a specific column for the logging of turbidity.
- c) The SOP criterion for a non-turbid discharge, 50 NTU, may be sufficient for monitor wells used to measure NAPL thickness, water levels, etc. However, a "turbidity-free" discharge is required for wells used to measure ground water quality, particularly for such parameters as metals, PCBs, PAH's, etc.

**PHASE IA REMEDIAL
INVESTIGATION
BAYONNE PLANT
BAYONNE, NEW JERSEY**

**VOLUME I OF III
TEXT AND TABLES**

December 1995

Prepared for

Exxon Company, U.S.A.
P.O. Box 728
Linden, New Jersey 07036

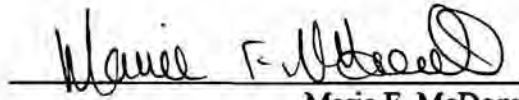
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**PHASE IA REMEDIAL
INVESTIGATION
BAYONNE PLANT
BAYONNE, NEW JERSEY**

December 12, 1995

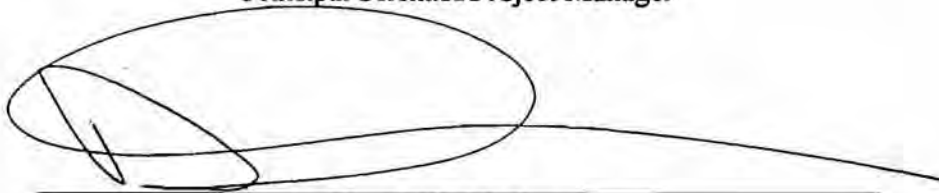
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Marie F. McDonnell
Project Scientist



Brian A. Blum
Principal Scientist/Project Manager



Daniel A. Nachman
Vice President/Project Officer



**PHASE IA REMEDIAL
INVESTIGATION
BAYONNE PLANT
BAYONNE, NEW JERSEY**

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**PHASE IA REMEDIAL
INVESTIGATION
BAYONNE PLANT
BAYONNE, NEW JERSEY**

1.0 INTRODUCTION

In September 1992, Geraghty & Miller, Inc. was retained by Exxon Company, U.S.A. (Exxon) to prepare a work plan for the implementation of a Remedial Investigation (RI) of the Bayonne Plant in Bayonne, New Jersey (the Site) pursuant to an Administrative Consent Order (ACO) issued by the New Jersey Department of Environmental Protection (NJDEP), dated November 27, 1991. The Bayonne Plant is an approximately 288-acre petroleum products terminal that was historically owned and operated by Exxon (Figure 1-1). Since the signing of the ACO, Exxon has sold the majority of the Bayonne Plant to International Matex Tank Terminals (IMTT). This report documents the activities and findings of Phase IA of the RI, which was carried out in accordance with the procedures and protocols specified in the Bayonne Plant RI Work Plan (RI Work Plan) submitted to the NJDEP on January 20, 1993 (Geraghty & Miller, Inc. 1993a); the Memorandum entitled "Modification to the RI Work Plan" (Memorandum Modification), submitted to the NJDEP in October 1994 (Geraghty & Miller, Inc. 1994a); and the NJDEP Field Sampling Procedures Manual (NJDEPE 1992a).

The RI Work Plan proposed a three-phase approach to characterize the Bayonne Plant and identified the phases as Phase IA, IB, and II. The Phase IA RI field work was carried out from October 1994 to January 1995. The majority of the field work included the drilling and sampling of soil borings to classify soil nature and quality, the advancement and sampling of temporary drivepoints and permanent monitoring wells to evaluate groundwater quality, and the installation of temporary well points to determine the presence and specific gravity of free-floating non-aqueous phase liquid (NAPL).

Phase IA RI field activities included the installation of a site-wide monitoring well network to complement the locations of existing on-site monitoring wells. These monitoring wells were



screened in the unconsolidated deposits to evaluate groundwater flow conditions. Additional field activities initiated in Phase IA included the following: a stratigraphic soil boring program consisting of soil sampling, bedrock coring, and the installation of additional intermediate and deep monitoring wells in the shallow unconsolidated deposits; a synoptic round of groundwater level and NAPL thickness measurements; and a groundwater sampling event of selected RI and pre-existing interim remedial measure (IRM) monitoring wells. The Phase IA data collection activities were designed to develop a conceptual model of groundwater flow conditions and to explore the Site for areas of affected soil and groundwater.

As required by the ACO, NAPL IRM investigations are being conducted at the Bayonne Plant, in accordance with a NJDEP-approved work plan prepared by Dan Raviv Associates, Inc. (DRAI) (Dan Raviv Associates, Inc. 1993a). The NAPL IRM investigations at the General Tank Field, No. 3 Tank Field, Exxon Chemicals Plant Area, and Lube Oil Area, were conducted concurrent with RI activities, and involved the drilling of soil borings and installation of temporary well points and permanent monitoring wells. The results of the NAPL IRM field investigation were documented separately in the NAPL IRM investigation report submitted to the NJDEP on July 25, 1995 (Geraghty & Miller, Inc. 1995a).

1.1 PURPOSE AND SCOPE

The purpose of the RI is to characterize the nature and extent of contamination in soil and groundwater resulting from past activities at the Bayonne Plant, consistent with the ACO and the intent of the NJDEP "Technical Requirements for Site Remediation" (NJDEP 1993). The information collected during the RI will be used in the context of other potential contamination sources in this highly industrialized region to support an informed technical and risk management decision regarding the most appropriate remedy (or, where appropriate, no further action) for the Bayonne Plant.

To accomplish the requirements outlined in the ACO for the Bayonne Plant, the scope of work for the RI is being conducted in a phased manner, in which data collected during the Phase



IA field investigation will be used to refine the scope and focus of subsequent field activities. The Phase IA effort has facilitated planning of the scope of work for the remaining field efforts needed to achieve the objectives of the RI. The sampling efforts of the remaining RI field work in Phase IB will be focused to address Phase IA data gaps, as well as to fulfill the objectives of Phase (discussed below).

Phase IA of the RI was designed to develop a conceptual model of groundwater flow conditions and to explore the Site for areas of affected soil and groundwater. This objective was accomplished primarily by drilling 84 shallow soil borings at the Site and by installing a drivepoint, temporary well point, or monitoring well in these borings. At 69 of these locations, the boreholes were grouted after the completion of soil sampling and the removal of a drivepoint or temporary well point. At the remaining 15 borehole locations, groundwater monitoring wells were installed in accordance with NJDEP specifications. At four other locations, deep stratigraphic borings were drilled until bedrock was encountered to confirm the depth to bedrock. Three intermediate and four deep monitoring wells were installed at these locations. Ambient air monitoring data were collected to evaluate the impact of field activities on air quality; these data are briefly discussed in this report.

NAPL IRM investigations were implemented concurrently with the Phase IA field activities in the following areas of the Bayonne Plant: the No. 3 Tankfield, the General Tankfield, the Exxon Chemicals Plant (which involved the Utilities Area), and the Lube Oil Area. This work included the drilling of 32 additional soil borings and the installation of temporary well points, primarily to identify areas of the Bayonne Plant where NAPL can freely enter a standpipe or monitoring well and float on the water table. At five of these soil boring locations, a monitoring well was later installed because floating NAPL was detected in a temporary well point. To complement the Phase IA RI, the analytical scope of the IRM investigations was expanded to include soil sampling for laboratory analysis from 14 of the 32 IRM soil boring locations. The results of the soil analytical program and the temporary well point program are discussed in this report; detailed descriptions of the IRM methodologies are presented in the NAPL IRM Field Investigation Report (Geraghty & Miller, Inc. 1995a).



Collectively, the Phase IA effort and the NAPL IRM investigations resulted in the installation of 20 shallow monitoring wells, three intermediate monitoring wells, and four deep (overburden) monitoring wells. Groundwater samples were collected from 31 monitoring wells at the Site that did not exhibit floating NAPL. These wells included newly installed monitoring wells and historical and existing IRM wells.

Subsequent phases (Phase IB and II) of the RI will be designed to complete the requirements of the ACO. Phase IB will delineate the extent of floating NAPL and the extent of groundwater affected by dissolved constituents, and will address the soil quality data gaps that persist after the Phase IA RI effort. Phase II will be designed to complete site characterization and contaminant delineation and to provide the data needed to evaluate the feasibility of potential remedial approaches. Soil, sediment, and groundwater sampling for risk assessment purposes may be conducted throughout the RI investigation, as needed.

1.2 SITE LOCATION AND DESCRIPTION

A discussion of the general site location and setting and a detailed description of the terms used throughout the Phase IA RI report to designate specific "Operational Areas" and "Study Areas" are presented in the following sections.

1.2.1 General Site Location

The Bayonne Plant (the Site) is located at 250 East 22nd Street, Bayonne, New Jersey (see Figure 1-1). The Site occupies approximately 288 acres (250 land and 38 riparian waterfront acres) and is situated in the southeastern portion of Hudson County, which is referred to as Constable Hook, an industrialized peninsula in Upper New York Bay. The Site is located in the southwestern part of the Jersey City, New Jersey, U.S. Geological Survey (USGS) (1981) topographic quadrangle (see Figure 1-1). The Bayonne Plant property is shown on the 1986 City of Bayonne tax map(s) as the following block(s) and lot(s), in accordance with the ACO: Block



419, Lots 1, 3, and 4; Block 427, Lot 3; Block 465, Lots 1 to 5 and 9; Block 466, Lots 1 through 4; Block 477.01, Lot 3; Block 478, Lot 1; Block 480, Lot 1; and Block 418, Lots 3 and 4. In 1993, most of the Bayonne Plant, with the exception of the Lube Oil Area, the Contiguous Pier No. 1 Area (Block 478, Lot 1), and the Stockpile Area (Block 477.01, Lot 3), was purchased by IMTT. Copies of the relevant tax maps and a list of tax map lot and block numbers for the Bayonne Plant is provided in Appendix A.

The Bayonne Plant consists of a variety of features including offices, process areas, mechanical shops, warehouses, tank fields, pipelines, substations and other utility areas, railroad sidings, a helipad, tanker docks and piers, truck loading stations, and two wastewater treatment plants. The Bayonne Plant is bounded to the north by 22nd Street and Hook Road, to the east by Upper New York Bay, to the south by neighboring industries and the Kill Van Kull waterway, and to the west by the Platty Kill Canal and adjacent property that is also owned by IMTT (see Figure 1-2).

The Bayonne Plant is surrounded by heavy and light industry, interconnected by a transportation network of roadways, railroads, and the navigable waters of the Kill Van Kull and Upper New York Bay. The general vicinity of the Site is the largest urbanized area (the New York-Northeastern New Jersey Urbanized Area) in the United States (Forstall 1992). This area is noted by the U.S. Census Bureau as the most populated in the United States (16,044,012 inhabitants) and one of the most populated areas in the world (U.S. Census Bureau 1990).

1.2.2 Definition of Operational Areas and Study Areas

The RI scope of work was designed to focus on potential or suspected locations of contamination. Due to the extensive history of operations (over 120 years) at the Bayonne Plant and the diversity of operations in the various areas within the plant, Exxon and Geraghty & Miller thought that RI activities may vary between areas based on the nature of the operations, the size of the area, and existing contamination information. Therefore, the Site was divided into 13 "operational areas." Details regarding the definition and boundaries of the operational areas are



provided in the Site History Report (Geraghty & Miller, Inc. 1994b). The 13 operational areas, as shown on Figure 1-3, are as follows: "A"-Hill Tank Field, Lube Oil Area, Pier No. 1 Area, No. 2 Tank Field, Asphalt Plant Area, AV-Gas Tank Field, Exxon Chemicals Plant Area (Chemicals Plant Area), No. 3 Tank Field, General Tank Field, Solvent Tank Field, Low Sulfur Tank Field, Piers and East Side Treatment Plant Area, and Domestic Trade Area. Four miscellaneous areas were also identified. These are the Stockpile Area, the MDC Building Area, the Utilities (Power Plant) Area, and the Main Building Area (see Figure 1-3).

Throughout this report, the term "area" will be used to describe recognized parts of the Site, such as IRM study areas, former operational/process areas, and active operational/process areas. These areas will be described specifically with an appropriate modifier and the "A" in area will be capitalized (e.g., the Domestic Trade Area, the East Side Treatment Plant Area, or the Main Building Area). Other previously unrecognized areas will be discussed within this report to describe the results of the Phase IA RI. These areas will be cited with a modifier, but the "A" in area will not be capitalized (e.g., the Tanks 1066, 1067, and 1068 areas).

1.3 REPORT ORGANIZATION

This Phase IA RI Report is consistent with the intent of NJDEP's "Technical Requirements for Site Remediation" (NJDEP 1993) and the ACO, and has been developed in a format suggested by the United States Environmental Protection Agency (USEPA). This report format is consistent with the format of the Phase IA RI Interim Report for the Bayway Refinery, which has been discussed and reviewed with the NJDEP Case Management Team. Section 2.0 provides historical information related to Bayonne Plant operations, surrounding land use, and previous environmental investigations. A more detailed discussion of Site background information has been presented in the Site History Report (Geraghty & Miller, Inc. 1994b). Section 3.0 discusses the field and analytical methods used during the implementation of Phase IA field activities, and Section 4.0 discusses the physical and hydrogeologic setting of the Site. Section 5.0 presents the findings of Phase IA of the RI, with subsections summarizing soil quality, occurrence of NAPL, and groundwater quality at the Bayonne Plant. Section 6.0 presents an overview of constituent and site



properties affecting fate and transport. Section 7.0 provides an evaluation of the data, development of hypotheses, and conclusions regarding the fate and transport of contaminants in various areas of the plant. Section 8.0 presents the references used in the report. All tables and figures are provided at the end of the report, separated by tabs and enumerated in accordance with the section of the report in which they are first referenced.

Appendices A through K provide additional information. A map and list of the tax block and lot numbers for the Bayonne Plant is presented in Appendix A. Sample/core logs for soil boring and monitoring well boreholes are presented in Appendix B. These logs have been edited to provide uniform interpretation of conditions observed in the field. Sample event/criteria forms used for entering soil sample field information into the database, and chain-of-custody forms used for tracking samples during shipment, are provided in Appendix C. Monitoring well construction logs and the NJDEP Groundwater Monitoring Well Form B-Location Certification Forms are provided in Appendix D. Bedrock core logs prepared during the stratigraphic soil boring program are provided in Appendix E. Groundwater sampling logs from the January 1995 Phase IA groundwater sampling event are provided in Appendix F. Health and safety air monitoring readings and results of well head air monitoring are presented in Appendix G. The validated soil and groundwater sampling analytical results are provided in ASCII files on 3½-inch, high-density diskettes in Appendix H and Appendix I, respectively. A quality assurance/quality control (QA/QC) summary is provided in Appendix J. Downhole field parameter data are provided in Appendix K.

The report is intended to be viewed as an interim deliverable and not as the complete RI Report for the Bayonne Plant. Its purpose is to help guide subsequent data collection efforts under Phases IB and II. Many of the figures and tables and much of the text of this report will be revised to incorporate the addition of Phases IB and II data. All appropriate comments from the NJDEP regarding the information presented in this report will be incorporated into either the Phase IB or the Phase II draft RI reports. The Phase II draft RI report will document the activities and findings of all phases of the RI. Therefore, consistent with the goal of completing all phases of the RI in a timely manner and expediting remedial decisions, it is not planned for this report to undergo

revision and resubmission. However, contents may be revised and incorporated into future deliverables, as discussed above.

1.4 CONSIDERATION OF REMEDIAL INVESTIGATION AND INTERIM REMEDIAL MEASURE FINDINGS

As part of the Sewer IRM required by the ACO, plant sewers have been undergoing cleaning and video camera inspection under the direction of IT Corporation. During a November 2, 1995 meeting between Exxon and NJDEP, a means of consolidating findings of the Sewer IRM and the Phase IA RI effort were discussed. In subsequent discussions with NJDEP, Exxon has agreed that a series of reports will be prepared by IT Corporation, documenting the work performed, and the findings for the various trunk lines of the Bayonne Plant sewer system.

These reports will include maps of the sewer systems depicting findings of the Sewer IRM work programs, with the Phase IA RI NAPL plume configurations and groundwater contour overlaid on them. The reports will assess the extent to which there appear to be correlations between Phase IA RI findings and NAPL and Sewer IRM findings, the extent to which sewer pipe is likely to be submerged below the groundwater table, and other factors which aid in definition of data gaps for additional phases of the RI. Information from these reports will be used in consideration of long-term remedial measures for the site.



2.0 HISTORICAL INFORMATION

This section provides a brief summary of the site history, surrounding land use, and previous environmental investigations, including previous and ongoing IRMs. Where appropriate, data from other investigations conducted prior to, or concurrent with, the Phase IA RI field activities were incorporated into this report. A detailed description of the history of Bayonne Plant operations and previous studies is presented in the Site History Report (Geraghty & Miller, Inc. 1994b).

2.1 SUMMARY OF SITE HISTORY AND SURROUNDING LAND USE

Since the late 1800s, nearly all of Constable Hook has been occupied by the petrochemical industry. The Prentice Refining Company established a small kerosene refinery in the Constable Hook Area in 1875. This operation consisted of 12 refining stills and was located in the areas of the Bayonne Plant currently occupied by the Lube Oil Area and a portion of the "A"-Hill Tank Field (Fairchild 1994). In 1877, John D. Rockefeller, representing Standard Oil Company (the predecessor company of Exxon), purchased the Prentice Oil Company refinery and several adjacent tracts of land totaling 176 acres (Fairchild 1994). From 1877 to approximately 1971, the Bayonne Plant was operated as a refinery and, up to 1936, underwent significant growth and expansion. During this period, Exxon, under the name of its predecessors (Standard Oil Company [New Jersey] and Standard Oil Company of New Jersey), purchased numerous surrounding tracts of land on Constable Hook.

The Standard Oil Company owned and operated approximately 650 acres on Constable Hook during the peak of plant operations in 1936 (Exxon Company, U.S.A. 1988). From 1936 through 1947, Standard Oil Company sold numerous parcels of land to various industries.

Between 1940 and 1947, the Constable Hook Area was extensively developed as a petrochemical area containing a network of railroad lines, roads, and piers for shipping. The northern portion of Constable Hook was undergoing extensive reclamation from Upper New York

Bay, and the southern portion of Constable Hook was occupied by hundreds of storage tanks. A major modernization and dismantling program began in 1955, and by 1963 one-third of the 330-acre plant lay vacant. In 1961, under an industrial development program adopted by Humble Oil & Refining Company (an affiliated company of Standard Oil) in cooperation with the City of Bayonne, numerous tracts of the plant property were sold to various industries for immediate construction (Humble Oil & Refining Company 1961).

The downsizing of plant operations continued throughout the 1960s until 1971, when all plant refining and manufacturing operations ceased, with the exception of the Exxon Chemicals Plant Area. Between 1974 and 1984, the area to the south of the Bayonne Plant was developed further by the petrochemical industry. By this time, the reclaimed area north of the General Tank Field was overgrown with vegetation. By 1989, the Bayonne Plant and its environs on Constable Hook resembled its present-day configuration.

In 1991, when the ACO was executed, Exxon owned 288 acres on Constable Hook, as depicted on Figure 1-2. On April 1, 1993, Exxon sold most of the property to IMTT, with the exception of the Lube Oil Area, the Pier No. 1 Area, and the Stockpile Area. Exxon still operates and maintains the Lube Oil Area as a lube oil and wax products storage, blending, and packaging terminal. The majority of the Bayonne Plant presently serves as a petroleum products storage terminal. The Asphalt Plant presently stores various grades of asphalt in aboveground storage tanks (ASTs). The Chemicals Plant area was formerly used by Exxon Chemical Americas to manufacture lube oil additives.

2.2 CHRONOLOGY OF PREVIOUS ENVIRONMENTALLY RELATED INVESTIGATIONS

Previous environmental investigations or pertinent environmental activities (including IRMs) at the Bayonne Plant for which documented data are available are described below. IRM activities at the Bayonne Plant are associated with NAPL, chromium, and the sewer system. The locations of NAPL IRM areas at the Bayonne Plant are shown on Figure 2-1. Historical



monitoring wells and recovery wells that currently exist at the Bayonne Plant are shown on Figure 2-2.

- In 1958, Hydrotechnic Corporation Engineers conducted a hydrogeologic investigation of the Bayonne Plant (Hydrotechnic Corporation Engineers, Inc. 1958). The hydrogeologic study involved a review of the stratigraphy and hydrogeology underlying the Site, based on available well records in the Bayonne area. The purpose of the study was to explore the potential to develop freshwater resources for refinery usage and the feasibility of disposing acid waste by underground injection. There is no indication that this activity was ever conducted at the Bayonne Plant. The geologic descriptions and stratigraphic data provided in this 1958 report were used by Geraghty & Miller to support the development of a preliminary conceptual model of Site geologic conditions.
- In 1974, Leggette, Brashears & Graham, Inc. conducted a groundwater monitoring program at the Bayonne Plant to evaluate shallow hydrocarbon contamination (Leggette, Brashears & Graham, Inc. 1974a,b,c). Monitoring wells were installed along the Lehigh Valley Railroad right-of-way and near the piers. NAPL thickness and water-level data from these wells were used by Geraghty & Miller in this report to supplement more recent NAPL IRM data in assessing areas of the Site that contain floating NAPL.
- Dames & Moore conducted a hydrogeologic investigation of the Bayonne Terminal and Chemical Plant in 1979 (Dames & Moore 1979). The study included a description of the regional and local hydrogeology based on geotechnical soil borings drilled in the 1950s, and a preliminary assessment of the potential to obtain permits for the oil/water separators at the East and West Side Treatment Plants. The data provided in this report were used to support the development of a preliminary conceptual model of Site hydrogeologic conditions.



- From the late 1970s to approximately 1989, Roy F. Weston, Inc. (Weston) conducted a subsurface oil recovery program at the Bayonne Plant (Roy F. Weston, Inc. 1980; 1981a,b; 1985; 1986a,b,c; and 1989a,b,c,d,e). Monitoring wells were installed in the Pier No. 1 Area near the helipad (formerly known as the Pier No. 3 Area), Pier 6 and Pier 7 Areas, "A"-Hill Tank Field, and Low Sulfur Tank Field. During this period, Weston initiated NAPL recovery programs in the pier areas and in the Low Sulfur Tank Field. NAPL thickness data collected by Weston were used by Geraghty & Miller in this report to help evaluate areas of the Bayonne Plant that contain floating NAPL.
- In 1985, Malcolm Pirnie, Inc. conducted a Potential Hazardous Waste Site Preliminary Assessment of the Bayonne Plant on behalf of the USEPA (Malcolm Pirnie, Inc. 1985). Background information in this document regarding site conditions and historical operations were used by Geraghty & Miller in the development of the Site History Report and the RI Work Plan (Geraghty & Miller, Inc. 1994b, 1993a).
- Sandaq, Inc., P.C. conducted a toxic substance investigation of the sewer system at the Bayonne Plant in 1986 (Sandaq, Inc., P.C. 1986). The sewer investigation involved a review and sampling of the sewer systems in nine areas of the plant. The results of the investigation concluded that certain areas of the plant had significant concentrations of organic compounds in the sewer system, and that steps should be taken to reduce organic loading to the sewers. The locations and analytical data for the sewer system were evaluated by Geraghty & Miller in the design and development of the scope for the Phase IA RI.
- In 1988, CH2M Hill, Inc. prepared a site water budget for the Bayonne Plant (CH2M Hill, Inc. 1988). Information regarding input and output wastewater and storm-water streams were incorporated by Geraghty & Miller into the Site History Report (Geraghty & Miller, Inc. 1994b).



- In 1990, the NJDEP conducted a site inspection of the Bayonne Plant and collected surface soil samples for chromium analysis (NJDEP 1990). In conjunction with the NJDEP study, Exxon conducted its own soil sampling and analytical program for chromium in January 1990. Chromium analytical data for soils were used in the development of the Site History Report (Geraghty & Miller, Inc. 1994b) and in the development of the scope for the RI Work Plan (Geraghty & Miller, Inc. 1993a).
- In April 1991, Environmental Resource Management, Inc. (ERM) collected soil samples throughout the Site for total and hexavalent chromium analysis (Dan Raviv Associates, Inc. 1992). The soil quality data from this study were incorporated into the Site History Report (Geraghty & Miller, Inc. 1994b).
- In 1992, ICF Kaiser Engineers, Inc., on behalf of Pittsburgh Plate and Glass Industries, Inc. (PPG), drilled soil borings in the General Tank Field and the No. 3 Tank Field areas (PPG Industries, Inc. 1992). Surface and subsurface soil samples collected from these soil borings were analyzed for chromium. The analytical results for chromium derived from this investigation were incorporated into the Site History Report (Geraghty & Miller, Inc. 1994b).
- NAPL IRM investigations, many of which are ongoing, have been conducted by DRAI and Geraghty & Miller. During the period from early 1994 through June 1995, DRAI conducted NAPL IRM investigations in the Platty Kill Canal Area, Helipad Area, Pier No. 6 Area, Pier No. 7 Area, and the Interceptor Trench (Dan Raviv Associates, Inc. 1994a,b; 1995a,b,c,d). Floating NAPL has historically been observed in all five of these areas, and NAPL containment/recovery systems are currently in operation in the Platty Kill Canal Area, the Pier No. 7 Area, and the Interceptor Trench area. NAPL containment/recovery systems are planned for the Helipad and Pier No. 6 Areas. Data collected during the NAPL IRM investigations typically included information regarding bulkhead construction, NAPL and water-level thickness data, pumping test data, NAPL recovery data, NAPL fingerprint data, and tidal fluctuation data. Similar data



were also obtained during NAPL IRM investigations in the Low Sulfur and Solvent Tank Fields (also referred to as the "Tank 1066" area) conducted by DRAI in 1992 and 1993 (Dan Raviv Associates, Inc. 1993b). A vacuum enhanced recovery (VER) recovery system for NAPL containment and recovery is currently being designed by Geraghty & Miller for implementation in the Tank 1066 area (Geraghty & Miller, Inc. 1995b). Concurrent with the Phase IA RI, a NAPL IRM investigation was also conducted by Geraghty & Miller during the period from October 1994 through January 1995 at the General Tank Field, No. 3 Tank Field, Exxon Chemicals Plant (Utilities Area), and Lube Oil Area (Geraghty & Miller, Inc. 1995a). Data generated during this investigation included observations of hydrocarbons in soil, and NAPL and water-level data from temporary well points and permanent monitoring wells. Quarterly NAPL and water-level monitoring was conducted during a 1-year period from 1994 to 1995 as part of the "A"-Hill Tank Field NAPL IRM (Geraghty & Miller, Inc. 1995c). Generally, data from the above NAPL IRM investigations were incorporated in this Phase IA RI report, as appropriate, to supplement Phase IA RI data regarding the nature and extent of floating NAPL and dissolved phase plumes.

- In 1993, ICF Kaiser Engineers, Inc. conducted a site-wide IRM investigation at the Bayonne Plant to address chromium contamination (ICF Kaiser Engineers, Inc. 1993, 1994). The investigation involved the collection of soil, air, and wipe samples for total and hexavalent chromium analysis, as well as a site inspection.
- IT Corporation has recently completed mapping, sewer cleaning, inspection, and videotaping of the sewer system at the Bayonne Plant (IT Corporation 1993; Exxon Company, U.S.A. 1995). The findings from the sewer integrity evaluations will be considered in conjunction with Phase IA RI findings as discussed in Section 1.4 (Consideration of Remedial Investigation and Interim Remedial Measure Findings) of this report.



3.0 TECHNICAL OVERVIEW - INVESTIGATION METHODOLOGY

This section discusses the field investigation methods used during the Phase IA RI. Specific details of the field procedures and protocols are discussed in the Field Sampling Plan (FSP) (Appendix A of the RI Work Plan [Geraghty & Miller, Inc. 1993a]). The organizational structure of the data collection activities was discussed in the Quality Assurance Project Plan (QAPP) (Appendix B of the RI Work Plan [Geraghty & Miller, Inc. 1993a]) and specific health and safety procedures are documented in the Health and Safety Plan (HASP) (Appendix C of the RI Work Plan [Geraghty & Miller, Inc. 1993a]). Generally, the methods employed in the field were either consistent with, or identical to, methods that are described in the NJDEP's Field Sampling Procedures Manual (NJDEPE 1992a). The Phase IB RI Work Plan will address the need to collect additional data throughout the Site to fulfill the intent of the Technical Requirements. Phase IA soil boring, monitoring well, and surface-water measurement point locations are presented on Figure 3-1. A summary of the number of soil and groundwater samples analyzed during the Phase IA RI is provided in Table 3-1.

3.1 SAMPLE DESIGNATION

Each sample collected during the Phase IA RI was given a unique designation that was documented in the field logs. The sample designation describes the following elements:

- The operational area code (representing each operational or miscellaneous area).
- The matrix code.
- The location number.
- The sample interval depth (for soil borings and drivepoints).

The operational area code is a prefix for each sample designation and is used to identify the part of the plant from which a given sample was collected or intended to evaluate.



A summary of operational area prefix codes is provided in Table 3-2. An operational area code was not designated for the Low Sulfur Tank Field because no soil borings or monitoring wells were drilled in this area as part of the Phase IA RI. In some areas (e.g., the No. 3 Tank Field), more than one prefix was used in order to distinguish between RI and IRM soil borings. Some exceptions to this prefix scheme occurred for a variety of reasons. These exceptions are included in Table 3-2.

Matrix codes are as follows:

Groundwater Monitoring Wells (GMMW)

Soil Boring (SB)

Drive Point (DP)

Because the sample identification is an important descriptive tool, examples are provided below to facilitate understanding of the various sample designations.

For the locations where soil borings were completed as monitoring wells, the monitoring well designation was used. Deep and intermediate monitoring wells were designated with the D and I suffixes, respectively.

Groundwater: GMMW10 (denotes a sample collected from Monitoring Well GMMW10, also designated as soil boring GTFSB6, a soil boring located in the General Tank Field Area).

Groundwater: GMMW23D (denotes a sample collected from the Deep Monitoring Well GMMW23D installed at the boring APSB-7 drilled in the Asphalt Plant Area to study the stratigraphy).



For soil boring samples, the last sample number reflects the bottom depth of the 2-foot long sample interval in the test boring. Soil borings drilled as part of the investigatory IRM study were distinguished by adding "IRM" to the boring location.

RI Soil Boring: AHTFSB01-02 (denotes the split-spoon sample collected in the interval from land surface to a depth of 2 feet from RI Soil Boring SB1 in the "A"- Hill Tank Field).

IRM Soil Boring: GTFIRMB06-08 (denotes the split-spoon sample collected in the interval from 6 feet to a depth of 8 feet from investigatory IRM Soil Boring SB6 in the General Tank Field)

Examples of drivepoint sample designations are as follows:

Drivepoint: N3TFBSB04-DP10 (denotes a drivepoint groundwater sample taken from the borehole of Soil Boring SB4 in the No. 3 Tank Field at the bottom depth of 10 feet).

Blind field replicate samples were given fictitious numbers, which were recorded in the file notes and project file.

Trip blank and field equipment blank samples were labeled as TB and FB, respectively, followed by a number and the date of shipment to the laboratory for trip blanks and date of concern for field blanks.

Trip Blank: TB102594 (denotes a trip blank sample prepared on October 25, 1994 for samples being shipped on the same day).

Field Blank: FBA110294 (denotes an aqueous field equipment blank prepared for aqueous samples collected on November 2, 1994).



Field Blank: FBNA02-100694 (denotes aqueous field blank Number 2, prepared for non-aqueous samples collected on October 6, 1994).

3.2 ANALYTICAL SOIL BORING AND DRIVEPOINT PROGRAM

As part of the Phase IA RI, 84 shallow soil borings were drilled at the Site from October 1994 through January 1995. Soil samples were collected for laboratory analysis from each of the Phase IA soil borings. At 69 of these Phase IA RI locations, the boreholes were grouted after the completion of soil sampling and the removal of a drivepoint or temporary well point (see Section 3.2.4 [Drivepoint Installation and Sampling] and Section 3.3.1 [Floating NAPL Delineation]). At the 15 remaining borehole locations, a groundwater monitoring well was completed according to NJDEP specifications. An additional 32 investigatory IRM soil borings were drilled at locations along the boundaries of the General Tank Field, No. 3 Tank Field, Exxon Chemical Plant (Utilities Area), and Lube Oil IRM study areas. Soil samples were collected for laboratory analyses at 14 of these 32 investigatory IRM Borings. Two of these 14 IRM soil borings were completed as shallow monitoring wells. Shallow soil boring locations were selected to investigate subsurface conditions near historical spills, former process areas, former oil/water separators, sewer and septic systems, and various potential areas of contamination (e.g., tanks, loading/unloading racks, drum storage areas), and to provide broad areal coverage of the Site. The rationale for Phase IA soil boring locations is outlined in Table 3-3 and presented in further detail in the Memorandum Modification (Geraghty & Miller, Inc. 1994a). Table 3-4 documents instances in which a planned boring or well was relocated because of specific site conditions. Location descriptions and the rationale for relocation of Phase IA monitoring wells and soil borings are presented in Table 3-4. The final locations of Phase IA soil borings, monitoring wells, and surface-water measurement points are shown on Figure 3-1.

All shallow soil borings were drilled using 4¼-inch inside diameter (ID) hollow-stem augers. A center bit (4-inch diameter tricone roller bit or equivalent) attached to AW-rods was used to prevent cuttings from entering the augers. Split-barrel core (split-spoon) samples were collected continuously through the auger flights prior to advancing the augers and the drill bit



assembly. Typically, a 24-inch long and 3-inch diameter, split-barrel core sampler was advanced into the formation by dropping a conventional 300-pound (lb) hammer from a height of 30 inches onto the sampling assembly. Occasionally, a 24-inch long by 2-inch diameter split-spoon core sampler was advanced with a 140-lb hammer where soil sampling was not conducted (e.g., investigatory IRM soil borings). Decontamination procedures for all sampling equipment and drilling equipment are presented in the FSP (Appendix A of the RI Work Plan [Geraghty & Miller, Inc. 1993a]).

Shallow soil borings were advanced into the formation until the water table was encountered. When water-table conditions were not easily identified (e.g., because a perched zone was present or saturated deposits were not encountered), soil borings were advanced to greater depths than originally planned. Except for stratigraphic soil borings, no soil borings were extended below a depth of 20 feet below land surface (bls). When hydrocarbon material was observed in soil samples, soil borings were advanced past the water table to a depth at which hydrocarbon was no longer present (without drilling through a confining soil unit). Final shallow soil boring depths ranged from approximately 12.5 to 18 feet bls.

Four of the six stratigraphic soil borings proposed in the Memorandum Modification (Geraghty & Miller, Inc. 1994a) were drilled at various locations throughout the Site (Figure 3-1). The purpose of the stratigraphic soil borings was to provide additional subsurface data to conceptualize site stratigraphy. Soil samples collected from stratigraphic borings were used to evaluate lithology, but were not submitted to the laboratory for analysis. Two of the proposed locations were not drilled during Phase IA because further information was not required (NJDEP 1994a). At three of the four stratigraphic soil boring locations, an intermediate and deep monitoring well cluster was installed (Figure 3-1). At the fourth stratigraphic soil boring location, a deep monitoring well was installed. The methods and procedures employed in the drilling of stratigraphic soil borings and the installation of intermediate and deep monitoring wells are described in Section 3.5 (Stratigraphic Borings).



3.2.1 Soil Sample Criteria

Split-spoon samples were collected continuously to the total depth of each boring for lithologic logging and screening with a flame ionization detector (FID). Two split-spoon samples were then collected at each borehole location for laboratory analysis. The two samples designated for laboratory analysis were selected based on criteria established in the RI Work Plan (Geraghty & Miller, Inc. 1993a) and the Memorandum Modification (Geraghty & Miller, Inc. 1994a) that incorporated visual evidence, FID headspace readings, determination of hydrocarbon presence, and QA/QC. The analyses conducted for Phase IA soil and groundwater are summarized in Table 3-1. Analytical parameters for surface and subsurface soil samples are also depicted on Figures 3-2 and 3-3.

Soil for potential volatile organic compound (VOC) analyses was collected from every 2-foot vertical interval immediately after the split-spoon sampler from a given 2-foot interval was opened. Soils from all of the intervals in the boring were then compared for FID headspace and the visual presence of hydrocarbon. Based on this comparison, two intervals were selected and sufficient additional soil was collected from these intervals for analysis of total petroleum hydrocarbons (TPH), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), target analyte list (TAL) inorganic parameters, and hexavalent chromium. Detailed soil-collection procedures are discussed below.

Once retrieved from the borehole, the split-spoon sampling device was placed on clean plastic sheeting covering a sturdy wooden table. On opening the split-spoon sampler, the field personnel used an FID and/or photoionization detector (PID) to screen the recovered soil in approximately 6-inch intervals within the 24-inch split-spoon sampler. The 6-inch soil interval that exhibited the highest FID/PID readings within the sampler was immediately placed in a laboratory-provided vial for potential laboratory analysis for VOCs. If elevated FID/PID readings were not observed within the 2-foot interval, a potential VOC sample was taken from a 6-inch interval at the center of the split-spoon sampler. In addition to FID screening, the entire contents of the split-spoon sampler were described for lithology, using the Unified Soil Classification System, and



measured with a ruler to determine sample recovery. Database-generated sample/core logs are presented in Appendix B. When recording the lithology of each split-spoon sample, the field hydrogeologist included a description of any hydrocarbons in the soil based on the visual appearance of the sample (see Section 3.2.3 [Hydrocarbon Identification in Soil]). A small amount of soil from the same 6-inch interval where VOC samples were collected was placed in a plastic Zip-lock bag for headspace screening with an FID or PID. The split-spoon sampling device was then closed, and its ends were covered with small plastic bags and sealed with rubber bands. The split-spoon sampler was stored in a sturdy, covered, wooden rack with slots marked with the sample depth. After all of the split-spoon samplers had been recovered, sampled, and stored as described above, headspace readings for each 2-foot interval were taken using the procedures outlined in the FSP (Appendix A of the RI Work Plan [Geraghty & Miller, Inc. 1993a]).

Using the headspace readings and the sample descriptions, the field hydrogeologist applied the following criteria to select the two laboratory sample intervals from each boring and assigned the boring a criteria number based on the following observations and sampling selection protocol:

- 0 Insufficient recovery from sample intervals throughout the boring or sample intervals are predetermined (i.e., QA/QC replicate) or other deviation from criteria (e.g., unknown materials, anomalous color change).
- 1 No visual evidence of hydrocarbons. No FID readings. Collect 0- to 2-foot interval and the interval located directly above the water table.
- 2 No visual evidence of hydrocarbons. FID readings. Collect samples from the interval with the highest FID reading and interval with next highest FID reading. If possible, sampling intervals should be 2 feet apart.
- 3 Hydrocarbons visually present but in less than 75 percent of total boring depth. Collect one sample from the zone containing hydrocarbons and the second sample from the interval with the highest FID readings. If possible, the soil collection



intervals should be separated by several feet for broader vertical characterization of soil quality.

- 4 Hydrocarbons visually present in greater than 75 percent of total boring depth.
Collect samples from the shallowest and deepest intervals containing hydrocarbons.

After the two sample intervals selected for laboratory analysis had been determined, the split-spoon samplers for those intervals were re-opened, homogenized in stainless-steel bowls, and transferred to laboratory-supplied containers. The samples previously collected from the two selected intervals for VOC analysis were retained, and the other samples previously collected from the boring for VOC analysis were properly disposed.

3.2.2 Soil Sample Analytical Selection Criteria

The two soil samples selected from each borehole (see Section 3.2.1 [Soil Sample Criteria]) were analyzed for TPH and hexavalent chromium. In instances where a borehole was terminated at depths of less than 5 feet because of shallow groundwater conditions or subsurface interference, only one sample was analyzed. Soil samples selected for TPH and hexavalent chromium analysis were also considered for potential analysis of the following:

- Target compound list (TCL) VOCs plus hexane, methyl tertiary butyl ether (MTBE), 1,2-dibromoethane, tertiary butyl alcohol (TBA), N-butyl alcohol, sec-butyl alcohol, N-propyl benzene, and isopropyl alcohol.
- TCL SVOCs.
- TCL pesticides/PCBs.
- TAL inorganic compounds plus cyanide.



The initial goal of the Phase IA field program was to analyze approximately 25 percent of those samples being analyzed for TPH and chromium for this expanded list of constituents. After the analytical results of TPH in soil for a given sample group (e.g., those samples collected in a day) were received, a "secondary request for analysis" was made. The laboratory was instructed to further analyze selected samples that had been containerized and refrigerated for an expanded list of parameters. The samples selected for secondary analysis were chosen based on the following criteria:

- Bias was given to those soil samples with relatively high TPH results in a given area.
- Samples were selected for broad areal distribution across the Site and within each operational area.
- Samples were selected to represent the vertical profile of the vadose zone, but were biased toward the 0 to 2-foot interval because of the surface-exposure potential. Where the 0 to 2-foot interval from a soil boring was selected for laboratory analyses based on the soil sample criteria (Section 3.2.1), the analyses were pre-designated for the expanded parameter list.
- Other predetermined locations were analyzed for the expanded list of constituents based on site history and operations information as discussed in the Site History Report and Memorandum Modification (Geraghty & Miller, Inc. 1994b, 1994a) or for QA/QC purposes.

3.2.3 Hydrocarbon Identification in Soil

Determining the visual presence of hydrocarbon in split-spoon soil samples was an important part of the Phase IA soil boring program because of its significance to the Site soil characterization and because the presence or absence of hydrocarbon was used to govern the selection of soil samples for laboratory analysis. When recording the lithology in each split-spoon



sample, the field hydrogeologist included a description of any hydrocarbons in the soil based on the visual appearance of the sample. The following determination regarding the presence of hydrocarbon was made and documented on the sample event/criteria forms provided in Appendix C.

- Y Yes, hydrocarbon appears to be present in the soil as "visually observed" and confirmed with the FID and/or odor.
- N No, hydrocarbon is not present in the soil. There are no visual or instrument indications of hydrocarbon.
- T Trace, there is either an extremely small amount of hydrocarbon present (e.g., only 1 inch of tar-like residual or droplets over the length of a 10-foot boring) or hydrocarbon is suspected because of the presence of a sheen, but generally not over a vertical interval greater than 2 inches.

High total VOC readings from the initial screening of the soil with an FID was considered an indicator of the possible presence of hydrocarbons. In addition to visual and field instrument screening of the soil, several field methods were used to determine the presence of hydrocarbon. Typically, a small amount of soil from the split-spoon sampler was placed on the plastic-covered sample table, squirted with a small amount of distilled water, and observed for the presence of a sheen on the surface of the water. Occasionally, a small amount of soil was placed in a Zip-lock bag with sufficient water added to saturate the soil. The bag was sealed and agitated, then opened to check for the presence of a sheen on the surface of the water.

3.2.4 Drivepoint Installation and Sampling

Where no hydrocarbons or only trace hydrocarbons were observed in soil samples from a boring, a temporary drivepoint was installed to collect a groundwater sample from this location. Thirteen groundwater samples were collected from drivepoints or temporary well points at soil



boring locations during Phase IA of the RI. These samples were analyzed in the laboratory for TCL VOCs (and eight additional site-specific VOCs).

Drivepoints consisted of a 3-foot long and 2½-inch diameter, continuously wound, stainless-steel screen with 0.020-inch (20-slot) openings and a conical point to facilitate advancement into the formation. Five-foot long, galvanized steel riser sections were threaded to the drivepoint screen to construct the desired length. The drivepoint technique used during the Phase IA RI was a modification of one of the methods outlined in the NJDEP "Alternative Groundwater Sampling Techniques Guide" dated July 1994 (NJDEP 1994b). The drivepoints and riser sections were decontaminated according to the procedures outlined in the RI Work Plan (Geraghty & Miller, Inc. 1993a) and stored in clean plastic until use.

Continuous split-spoon sampling was conducted at each soil boring. At the first clear indications of water-table conditions (i.e., the fully water-saturated split-spoon sampler), the drivepoint was inserted through the auger flights to a depth of approximately 2 feet below the water-table depth. In some cases, the drivepoint was pushed to the desired depth using the hydraulic drill head. In most cases, a split-spoon sampler was advanced below the water table to confirm water-table conditions and lithology, and the drivepoint was lowered into the hole made by the final split-spoon sampler.

Prior to being sampled, the drivepoint was purged of either three volumes of standing water (if it recharged) or one volume of standing water (until complete evacuation) using a clean Teflon bailer to promote collection of a representative groundwater sample. A 40-milliliter (mL) sample of groundwater was collected for laboratory analysis of the TCL VOCs from the drivepoint consistent with the procedures outlined in the Memorandum Modification (Geraghty & Miller, Inc. 1994a).

Based on the geology and water-table conditions encountered at specific boring locations, a few exceptions to the guidelines for the depth of drivepoint installation and purging were made. At some locations, perched groundwater existed at shallow depths. Where perched water was



suspected in a boring, split-spoon sampling continued until 3 to 4 feet of saturated soil were encountered, indicating true water-table conditions. In other instances, marginally confined conditions caused the water level inside the augers and drivepoint to rise above the top of the drivepoint screen; in this situation, samples did not represent the water-table surface. In still other locations, particularly in clayey soils, the soil did not yield sufficient water for sampling. In these instances, the drivepoints were left in the borehole for as long as 24 hours to allow groundwater to enter the screen. Drivepoints were always removed within 48 hours. In extremely low permeability deposits that did not recharge the drivepoint, the drivepoints were not purged before sampling, and the auger flights were entirely removed to allow water from the entire depth of the borehole to enter the drivepoint.

3.3 HYDROCARBON DELINEATION - TEMPORARY WELL POINT PROGRAM AND HYDROMETER TESTING

Hydrocarbon in soil was observed in accordance with the procedures outlined in Section 3.2.3 (Hydrocarbon Identification in Soil). Evidence of petroleum hydrocarbons was observed in 94 of the 116 soil borings (i.e., 84 RI soil borings and 32 investigatory IRM borings) drilled. Delineation of floating NAPL in the subsurface involved the use of temporary well points. Temporary well points were installed in 77 of the 94 soil borings in which petroleum hydrocarbons were observed in soil. To characterize the physical characteristics of floating NAPL and to apply an appropriate correction factor to site groundwater elevation data, NAPL observed in temporary well points and monitoring wells was subjected to hydrometer testing. The methodologies and procedures employed in implementing the temporary well point program and hydrometer testing are described below.

3.3.1 Floating NAPL Delineation

Determining the presence or absence of floating NAPL was an important part of Phase IA; this determination was accomplished by installing temporary well points. These temporary well points were installed at locations where hydrocarbon appeared to be present in soils based on a



"yes" determination, as specified in Section 3.2.3 (Hydrocarbon Identification in Soil). The well points were used to evaluate if the hydrocarbon was free to migrate into a well screen or if it was bound to the soils and would not migrate. If the hydrocarbon observed in the subsurface environment was saturated enough to migrate into a temporary well point or well screen, then it was defined as floating NAPL. Floating NAPL was typically described as a sheen or as a measurable thickness on the water table. Non-saturated bound hydrocarbons were typically described as droplets within soil interstices, as thick tar-like material, or as unique or unknown materials.

When the field hydrogeologist determined that hydrocarbon was visually present in the soil samples from the boring as confirmed with an FID (a "yes" determination), a temporary 2-inch diameter polyvinyl chloride (PVC), stainless-steel, or galvanized steel well screen (continuously wound, 20 slot) was placed in the open borehole to monitor the presence and/or thickness of floating NAPL on the water table. The well screen was inserted to the total depth of the boring and the auger flights were removed. The temporary well point was left in place undisturbed for a maximum period of approximately 2 weeks, during which time the water surface was measured using an electronic oil-water interface probe at 2- to 4-day intervals for floating NAPL. If NAPL was consistently measured in a well point within several days of its installation and a determination was made that the thickness of NAPL was not likely to change over time, the well point was often removed. If the oil-water interface probe indicated that NAPL was present, a visual inspection of the water surface and the water at the bottom of the well screen was made by lowering a bailer and retrieving a sample.

Well permits were obtained from the NJDEP Bureau of Water Allocation for temporary well points that were left in place for more than 48 hours. Soil borings that did not exhibit petroleum hydrocarbons in soil and/or did not reveal floating NAPL in a temporary well point were abandoned in accordance with the procedures outlined in the NJDEP Field Sampling Procedures Manual (NJDEPE 1992a). These temporary well points were removed and the boreholes were grouted to the surface. Well abandonment forms for these temporary well points will be filed with the NJDEP Bureau of Water Allocation.



3.3.2 Hydrometer Testing

Hydrometer testing was performed in the field on NAPL samples from temporary well points and monitoring wells during Phase IA of the RI. The purpose of hydrometer testing was to evaluate the physical characteristics of floating NAPL, where present, and to determine the appropriate correction factors to apply to groundwater elevation data in generating a site-wide groundwater contour map. Specific gravity analyses were performed on NAPL samples from nine temporary well points (including RI and IRM well points), five Phase IA monitoring wells, and 35 existing monitoring wells at the Bayonne Plant. Hydrometer testing was conducted on NAPL samples from selected RI and historical wells concurrent with the collection of NAPL and water-level measurements on December 12, 1994.

Where a sufficient amount of NAPL was observed in either a temporary well point or a monitoring well, a sample of floating NAPL was collected using a disposable bailer. The NAPL was transferred in the field to a graduated cylinder, into which a hydrometer was placed. NAPL specific density was then read directly from the assembly.

3.4 SHALLOW MONITORING WELL INSTALLATION

As part of the Phase IA RI, 15 shallow monitoring wells were installed at the Site from October 1994 through January 1995. Five additional shallow monitoring wells installed in the General Tank Field, No. 3 Tank Field, Exxon Chemical Plant (Utilities Area), and Lube Oil investigatory IRM study areas were also utilized as part of the Phase IA RI for soil and/or groundwater sample collection. Monitoring well locations were selected to provide broad areal coverage to evaluate groundwater flow conditions and to investigate soil and groundwater quality near potential locations of contamination (e.g., spills, former process areas, former oil/water separators, septic systems, loading/unloading racks). The rationale for Phase IA monitoring well locations in each investigative unit is presented in Table 3-3. Final monitoring well locations are shown on Figure 3-1.



Monitoring wells were constructed using 4-inch diameter, flush-joint, internally threaded, schedule 40 PVC well screen and riser. The PVC well screens were made of continuous wire wound screen (Johnson V-Wire) with a 0.020-inch slot size (20 slot). A No. 0 Morie Sand was placed approximately 0.5 to 3 feet below the bottom of the screen to approximately 1 to 2 feet above the top of the screen in all wells. A 0.5 to 2.5-foot thick bentonite seal was emplaced by tremie pipe above the sand pack, and a cement grout slurry was emplaced by tremie pipe above the bentonite seal extending to land surface. Typically, wells were completed with the PVC riser 2 feet above grade, with a PVC slip cap or expanding gasket cap, and a locking, 6 5/8-inch diameter, protective steel casing that was set and grouted down to 2 feet below land surface. In high traffic areas, monitoring wells were completed at grade and filled with a flushmount cast iron manhole cover. A vent hole was drilled in the PVC riser to maintain atmospheric pressure in the well and prevent potential pressure and suction from interfering with water-level fluctuations. Monitoring wells were affixed with a permanent identification marker, including the well permit number, in accordance with NJDEP requirements.

Shallow monitoring well soil borings were completed according to the same procedures described in Section 3.2 (Analytical Soil Boring and Drivepoint Program), except that these soil borings were drilled with 6 5/8-inch augers instead of 4 1/4-inch augers.

Phase IA shallow monitoring well screens were set to straddle the water table, except where marginally confining conditions were encountered. Generally, the top of the well screen was set 2 to 5 feet above the depth at which water-table conditions were encountered in split-spoon soil samples. The bottom of the well screen varied in depth depending on the thickness of the stratigraphic unit in which the water table was encountered. Often, a judgment was made between constructing a well with sufficient screen length to yield water for efficient groundwater sampling and constructing a well discretely screened across only one lithologic type resulting in one unique hydraulic gradient. Shallow well screens ranged in length from 10 to 13 feet. Upon completion of all Phase IA monitoring wells, a datum marked at the top of the well casing was surveyed by Taylor, Weissman & Taylor of Dayton, New Jersey, a New Jersey-licensed land surveyor. Table



3-5 provides a summary of construction details for all monitoring wells installed during the Phase IA RI, and Appendix D contains the well construction logs and the Form B-NJDEP Location Certification Forms.

3.5 STRATIGRAPHIC BORINGS

To characterize and evaluate the vertical extent of the stratigraphy and the hydrogeologic conditions underlying the Site, a series of stratigraphic soil borings were drilled throughout the Bayonne Plant. Stratigraphic borings were drilled in the Pier No. 1 Area, Lube Oil Area, Asphalt Plant, and Piers and East Side Treatment Plant Area. At three of the four stratigraphic boring locations, an intermediate and deep overburden monitoring well cluster was installed. The fourth stratigraphic soil boring was converted into a deep overburden monitoring well. The locations of the stratigraphic borings and the intermediate and deep monitoring wells are shown on Figure 3-1.

3.5.1 Intermediate and Deep Well Installation

The intermediate wells were installed by casing off the upper shallow zone by drilling with a hydraulic (mud) rotary method and installing an upper steel casing; a lower PVC casing and screen were then installed through this upper steel casing. Wells were designed in this manner to permanently seal off any potential upper soil or groundwater contamination from lower water-bearing strata. Monitoring well construction details for the intermediate and deep wells are included in Table 3-5.

Specifically, the methodology used to install the intermediate wells during Phase IA of the RI was as follows:

- A 12-inch diameter borehole was drilled by the hydraulic (water or water plus pure bentonite) rotary method and advanced at least 2 feet into the meadow-mat layer.



- An 8-inch diameter steel casing, with a PVC cap on the bottom, was inserted into the 12-inch diameter borehole. The 12-inch diameter borehole was grouted in place by first filling half of the borehole with cement by the tremie pipe method and then sinking the casing, which was sealed at the bottom with a PVC cap, into the grout. This method is called displacement grouting and it was also used to install the deep wells. The casing was held down with the drill rig for a minimum of 12 hours.
- The PVC plug was penetrated, and split-spoon samples were collected through the 8-inch casing ahead of the 7 7/8-inch drilling bit; these soil samples were evaluated to select the screen setting of the well within the water-bearing zone.
- A 4-inch diameter PVC casing and screen were installed in the 7 7/8-inch diameter borehole and constructed in a fashion similar to the shallow monitoring wells.

All of the deep overburden monitoring wells were similarly installed using hydraulic mud rotary methods. Deep monitoring wells were installed with a double-cased borehole to prevent cross-contamination of water-bearing units and/or to permanently seal off shallow soil contamination that was observed in the vadose zone. The following is a description of the well installation method used for these wells:

- A 16-inch diameter borehole was drilled at least 2 feet into the local confining unit (either the meadow-mat layer and/or the glacial till unit).
- A 12-inch diameter steel casing (with PVC cap) was inserted into the 16-inch diameter borehole and grouted in place by using a displacement grouting technique.
- The casing and grout were allowed to set for at least 12 hours.
- The PVC cap was penetrated and split-spoon samplers were advanced and telescoped through the 12-inch diameter casing to the next encountered confining unit.



- An 11 7/8-inch diameter borehole was drilled by hydraulic rotary method and was telescoped through the 12-inch diameter steel casing at least 2 feet into the next encountered confining unit (alluvial clay layer or glacial till).
- An 8-inch diameter steel casing (with PVC cap) was inserted into the 12-inch diameter borehole, grouted in place, and allowed to set for 12 hours.
- The PVC cap was penetrated and split-spoon samplers were advanced and telescoped through the 8-inch diameter casing to the borehole.
- A 7 7/8-inch diameter borehole was drilled by hydraulic rotary method and was telescoped through the 8-inch diameter steel casing to bedrock.
- A clean, 7 3/4-inch diameter, temporary casing (with diamond but hollow tip) was drilled approximately 0.5 foot into the top of the bedrock to create a watertight seal.
- The casings were flushed clear with potable water.
- Bedrock coring equipment was advanced and cores were obtained in 5-foot lifts using the standard, Diamond Core Drill Manufacturer Association (DCDMA) specifications for the "G"-group core barrels and NX-sized, flush-coupled casing and diamond bits.
- Bedrock coring was completed into competent rock (i.e., rock that was not significantly weathered) to a depth of 10 feet.
- The borehole was grouted to the approximate top of bedrock elevation.



- A 4-inch diameter PVC casing and well screen were installed in the 8-inch diameter borehole and constructed in a manner similar to the shallow monitoring wells.

3.5.2 Bedrock Coring

Bedrock coring was conducted at stratigraphic boring locations that were ultimately converted into deep monitoring wells. The bedrock cores have been retained by Exxon and are stored at the Bayonne Plant. Bedrock coring was conducted using the field methods described in the preceding section. During the 5-foot coring runs, the following information was recorded: depth of run, penetration, run duration (per foot), penetration rate, and down pressure (in pounds per square inch [psi]). After completion of the coring run, the core barrel was brought to the surface and analyzed by a Geraghty & Miller geologist. The following information was recorded: recovery, percent recovery, rock quality designation (RQD), lithology, fracture frequency, fracture fit, fracture spacing, orientation of fractures, degree of weathering, and any odors or discoloration observed in the rock core. Bedrock core logs are provided in Appendix E.

3.6 SYNOPSIS WATER-LEVEL MEASUREMENTS

On December 12, 1994, synoptic water-level measurements were obtained at the 22 monitoring wells installed during Phase IA (including five investigatory IRM monitoring wells), at 157 existing and historical IRM monitoring wells and recovery wells, and at seven surface-water measuring points. Water-level measurements were collected from 171 shallow monitoring wells, seven intermediate monitoring wells, and one deep monitoring wells. Each well was measured at low tide (approximately 10:18 a.m.) and at high tide (at approximately 16:15 p.m.) on this date. Measurements were made using either an electronic interface probe, or a weighted steel tape and indicator chalk, according to the measurement and decontamination procedures outlined in the RI Work Plan (Geraghty & Miller, Inc. 1993a). The water-level data were used to determine groundwater flow directions and the general presence and degree of influence of the tidal fluctuations in the Kill Van Kull and Upper New York Bay on groundwater levels across the Site. Surface-water elevations were also obtained relative to seven surface-water measuring points



established at fixed structures (i.e., points on piers and bulkheads) and existing staff gauges (i.e., PVC casing markers in the Platty Kill Canal) (Figure 3-1). Interpretation of the measurement data and Site groundwater flow is presented in Section 4.6.2.1 (Shallow Groundwater Flow).

3.7 GROUNDWATER SAMPLING

From January 23 to 27, 1994, groundwater samples were collected from 21 Phase IA monitoring wells and ten historical and existing IRM monitoring wells. Phase IA monitoring wells sampled included 14 shallow Phase IA monitoring wells, three intermediate monitoring wells, and four deep monitoring wells. Groundwater samples were not collected from six shallow monitoring wells (which includes five IRM monitoring wells) due to the presence of floating NAPL, as detected with an electronic oil/water interface probe or a steel tape and indicator paste, and confirmed with a bailer. Whenever possible, three volumes of the standing water in a well were purged prior to sampling, and no sampling was performed unless the total water column (at least one volume) was replaced by groundwater directly from the formation. Groundwater samples were not collected from new wells until at least 2 weeks after well development. Each well was purged using a centrifugal pump or a stainless-steel submersible pump, and dedicated tubing. All equipment used to purge the wells was documented on the water sampling logs, which are provided in Appendix F.

The temperature, pH, conductivity, dissolved oxygen (DO) content, and redox potential (eH) of the groundwater were generally measured during the purging of every well volume. Samples were collected within 2 hours after the well was evacuated. Low-yielding wells were evacuated to dryness and allowed to recover prior to sampling. All purge water was containerized in 55-gallon drums; then properly disposed into the on-site sewers or into a storage tank and transported for disposal at the on-site wastewater treatment plant.

Samples were collected using decontaminated, dedicated, bottom-loading Teflon bailers and Teflon-coated stainless-steel leaders (3 to 6 feet in length). In general, wells were sampled in the ascending order of contamination, with the least contaminated well being sampled first.



Samples were carefully poured into laboratory-supplied containers, avoiding agitation or turbulence that can result in the loss of VOCs and/or excessive oxygenation of the samples.

Sample bottles were filled in the following order: VOCs, SVOCs, TPH, PCBs/pesticides, total metals, dissolved metals, phenols, cyanide, sulfate and chloride, preserved inorganics, and non-preserved inorganics. Samples were shipped to the laboratory, CompuChem Environmental Corporation Laboratory of Raleigh, North Carolina (CompuChem), at the end of every day of the sampling event. Samples for analysis of dissolved gases (i.e., oxygen, nitrogen dioxide, methane, carbon dioxide, and carbon monoxide) were collected from monitoring wells using a peristaltic pump and transferred directly into zero-headspace sample containers. Samples for analyses of dissolved gases were shipped to Microseeps Laboratories of Pittsburgh, Pennsylvania (Microseeps). The chain-of-custody forms are provided in Appendix C with the sample/event criteria forms.

As required by the NJDEP, temperature, pH, specific conductance, DO, and eH measurements were also made at the time of sampling (after the VOC sample was taken) because these properties may change during storage. These field parameters were measured in situ using a HydroLab multiparameter downhole instrument. Field parameter readings were obtained at 2-foot depth intervals throughout the water column in each monitoring well. These data were recorded on the water sampling logs, which are presented in Appendix F. Field instrument types are outlined in the RI Work Plan (Geraghty & Miller, Inc. 1993a). Instruments were calibrated at the beginning of the day and checked periodically during the day.

To monitor the effectiveness of decontamination procedures, field blanks were collected during groundwater sampling. At the field location, analyte-free water was poured through the clean sample equipment and into sample containers for analysis. Field blanks were preserved in the same manner as other samples. Trip blanks were used to monitor possible VOC contamination of water samples during handling and transport. Blind duplicate samples were collected at a frequency of one for every 20 samples collected.



Groundwater samples were collected for analysis of both dissolved (filtered) and total (unfiltered) metals during the Phase IA field activities. Samples collected for dissolved metals analysis were filtered on-site prior to sample preservation. A glass flask and filter apparatus was used and precleaned with a 10 percent nitric acid (HNO_3) solution, followed by a distilled/deionized water rinse. A dedicated, cellulose-based, 0.45-micrometer (μm) membrane filter was used to filter samples. Field blanks for dissolved metals were collected by pouring laboratory-provided, deionized/distilled water through the entire filtering apparatus.

3.8 AMBIENT AIR MONITORING

The ambient air monitoring program was conducted to determine the appropriate level of protection for workers performing RI tasks. Appendix B, Section E.5(a) of the ACO required the characterization of baseline ambient air quality conditions throughout the Bayonne Plant and the identification of RI activities that may adversely impact ambient air quality.

Ambient air monitoring was conducted at the Site during all tasks and was implemented using appropriate field methods and instrumentation (PID or FID), as discussed in the FSP and HASP, Appendix A and Appendix C, respectively, of the RI Work Plan (Geraghty & Miller, Inc. 1993a). Characterization of baseline conditions and the development of a field screening program was accomplished by (1) wellhead monitoring and soil sample emissions analyses, and (2) air monitoring as outlined in the HASP. The results of the ambient air monitoring are summarized and presented in a table in Appendix G.

3.8.1 Flame Ionization and Photoionization Detectional Equipment

During intrusive RI activities, one of the following instruments were used to determine levels of personal protective equipment (PPE): a Foxboro OVA-128 FID, a Foxboro TVA-1000 FID/PID combination meter, or an HNU PID. To define appropriate levels of PPE, readings upwind of the work zone were monitored to determine background air quality. If action levels were exceeded within the work zone, intrusive work was stopped and workers were instructed to



move upwind of the work zone to let the area vent. If readings remained above the action levels, appropriate upgrades in PPE were made and work was continued. Approximately 95 percent of the RI investigative activities were conducted in Level D health and safety protection. The remaining 5 percent (work in the No. 3 Tank Field and Chemical Plant Areas), was conducted in Level C.

3.8.2 Draeger/Sensydine Tubes

If air monitoring readings were obtained (by the methods described in Section 3.8.1 [Flame Ionization and Photoionization Detectional Equipment]) above the action levels (as specified in the HASP), Draeger tube tests were conducted to determine the concentrations of benzene. If action levels for benzene were exceeded within the work zone, intrusive work was stopped and workers were instructed to move upwind of the work zone to let the area vent. If readings remained above the action levels, appropriate upgrades in PPE were made and work was continued.

3.8.3 Dust Monitoring

Historical use of chromium slag as fill material at various parts of the site necessitated the use of a random air monitor (RAM) for continuous measurement of dust (potentially chromium) within the work zone. The RAM was used to monitor for ambient particulate matter smaller than 10 microns (um). If action levels were exceeded within the work zone, dust was suppressed by using a water spray before work was resumed. Data were collected and stored in the RAM during the day and downloaded into a hard copy printout at the end of each work day.

3.9 QUALITY ASSURANCE/QUALITY CONTROL

During the Phase IA RI of the Bayonne Plant, 116 soil borings, including 32 IRM borings, were drilled; and 20 shallow monitoring wells, including five investigatory IRM wells, were installed. One hundred and eighty-one soil samples, 13 groundwater samples from drivepoints, and 31 groundwater samples from monitoring wells were collected and shipped to CompuChem for



analysis. A summary of the number of analyses conducted for Phase IA soil and groundwater samples is provided in Table 3-1. Figures 3-2 and 3-3 present the scope of the analyses performed on soil samples collected from the various soil boring and monitoring well locations.

All of the soil samples collected were analyzed for TPH by New Jersey-modified USEPA Method 418.1 and for hexavalent chromium by New Jersey-modified USEPA Method 3060A/7196. In addition, over 55 percent of the soil samples were analyzed for TCL VOCs and eight additional site-specific VOCs, TCL SVOCs, TCL pesticides/ PCBs, and TAL metals and cyanide. These analyses were performed according to the USEPA Contract Laboratory Program (CLP) methodology for organics and inorganics (USEPA 1991a, 1991b). Throughout this report, reference to the TCL/TAL plus miscellaneous parameters will include the parameters listed in the tables cited in Section 5.0 (Phase IA Findings). Analytical results for soil are provided on diskette in Appendix H.

Where NAPL was not detected in a drivepoint or temporary well point, a groundwater sample was collected. Of the 84 Phase IA RI soil borings drilled, 48 exhibited NAPL thicknesses of at least 0.01 foot or greater. A temporary drivepoint was installed in 13 of the remaining 36 soil borings where NAPL was not detected in a temporary well point. Groundwater samples were collected from the 13 drivepoints and analyzed for VOCs. Thirty-one monitoring wells were sampled and analyzed for TCL VOCs (and eight additional site-specific TCL VOCs), TCL SVOCs, TCL pesticides/PCBs, TAL metals (dissolved) plus total cyanide, hexavalent chromium, total iron and manganese, and TPH. The samples from these 31 wells were also analyzed for the following wet chemistry parameters: chemical oxygen demand (COD), biological oxygen demand (BOD), total organic carbon (TOC), ammonia, chloride, nitrate, sulfate, sulfide, total dissolved solids (TDS), phosphate, and alkalinity, and for the following dissolved gases: methane, carbon monoxide, carbon dioxide, nitrogen dioxide, and dissolved oxygen. Approximately 15 percent of the monitoring wells were analyzed for both total and dissolved TAL constituents. The TCL/TAL analytes were analyzed according to the USEPA CLP methodology (USEPA 1991a, 1991b). The remaining remedial parameters and the gases were analyzed by various standard USEPA methods



not regulated under CLP (see Section 5.3.2 [Groundwater Sampling Laboratory Analytical Results]). Analytical results for groundwater are provided on diskette in Appendix I.

Validation of 20 percent of the data based on the NJDEP guidelines (NJDEP 1991, 1992b, and 1992c) and a data usability assessment based on 100 percent of the data were performed in accordance with a letter dated October 12, 1994 from Ms. Susan Chapnick of Gradient Corporation to Ms. Linda Caramichael and Mr. James Bover of Exxon. Twenty percent of the Phase IA RI laboratory analytical data were selected for validation in accordance with NJDEP guidance (Boyer 1994), based on the following: (1) focusing on results indicating relatively low to moderate contaminant levels; (2) validating the sample results from all of the representative matrices (soil, sediment, and groundwater); (3) providing validation from a representative set of sample results from all operational areas; and (4) reducing data validation time by evaluating samples from the same sample delivery group (SDG), when feasible. The results of the field QA/QC are discussed in Sections 5.1.1 (Summary of Field QA/QC for Soil Samples) and 5.3.1 (Summary of Field QA/QC for Groundwater Samples). A summary of the data usability assessment is provided in Appendix J.

3.9.1 Soil Quality QA/QC

Field QA/QC samples included field blanks, blind field replicates, and matrix spike and matrix spike duplicates (MS/MSDs). The frequency of collection and associated analytical parameters are described below.

3.9.1.1 Field Blanks

Field blanks were collected at a rate of 10 percent of the total number of samples to evaluate potential cross-contamination during sampling and also to check the laboratory-prepared analyte-free water. Figures 3-2 and 3-3 present the scope of the laboratory analyses performed on soil samples collected from various locations at various depths, and Table 3-1 presents the total number of analyses conducted. A total of 18 field blanks was collected during the soil boring



program; all of them were analyzed for TPH and hexavalent chromium, except for four of the field blanks, which were not analyzed for hexavalent chromium because the hexavalent chromium analyses were suspended for 2 weeks (from October 5 to October 18, 1994) to give the laboratory sufficient time to implement modifications to Method 3060A/7196. In addition, nine of the field blanks were analyzed for the TCL/TAL parameters.

3.9.1.2 Blind Field Replicates

Blind field replicate samples were collected at a rate of one for every 20 soil samples to evaluate the reproducibility of the sampling technique. A total of nine replicates was collected during the soil boring program. All of them were analyzed for TPH and hexavalent chromium, except for one of the replicates, which was not analyzed for hexavalent chromium because the hexavalent chromium analyses were suspended for 2 weeks (see Section 3.9.1.1 [Field Blanks]). In addition, six of the replicates were also analyzed for the TCL/TAL parameters.

3.9.1.3 Matrix Spike and Matrix Spike Duplicates

MS/MSD samples were collected at a rate of one for every 20 soil samples to determine the precision (i.e., reproducibility) and the accuracy (i.e., the true analytical result) of the data. During the soil boring program, 12 MS/MSD samples were collected and analyzed for TPH. In addition, ten of the MS/MSD samples were also analyzed for the TCL/TAL parameters as well as hexavalent chromium.

3.9.2 Groundwater Quality QA/QC

As previously discussed, groundwater samples were collected during the soil boring program using drivepoints and temporary well points. A total of 13 drivepoints or temporary well points was installed for collection of groundwater samples and laboratory analyses for VOCs.



Two field blanks were collected with the drivepoint samples. Five trip blanks were analyzed for VOCs only on days that the drivepoints were shipped to the laboratory for analyses. Two blind field replicates were collected and analyzed for VOCs. Two MS/MSD samples were collected at a frequency of one per 2-week period that drivepoint samples were collected.

Thirty-one monitoring wells that did not contain floating NAPL were sampled for TCL VOCs (and eight additional site-specific VOCs), SVOCs, pesticides/PCBs, TAL dissolved metals plus cyanide, TPH, hexavalent chromium, dissolved gases, and wet chemistry parameters. Five of these wells were sampled for both total and dissolved metals to meet the requirements specified in the draft "Field Verification Procedures and Analysis Plan," prepared in conjunction with RI activities at the Bayway Refinery (Geraghty & Miller, Inc. 1993b).

Five field blanks and trip blanks were collected, one for each day of groundwater sampling. Two blind field replicates were collected to meet the requirement of one for every 20 samples. Two MS/MSD samples were collected to meet the requirement of one for every 20 samples.

3.9.3 Technical Data Usability Assessment

A technical data usability assessment was performed by Gradient Corporation on 100 percent of the TCL/TAL, and hexavalent and total chromium analytical data. The primary objective of the data usability assessment was to quantify, where applicable, the uncertainty in the data so that the end user was aware of the potential biases, false-negatives, and false-positives in the analytical data. The data usability was performed in accordance with the criteria defined in the NJDEP Data Validation Statement of Procedures (SOP) (NJDEP 1991, 1992b, and 1992c), National Functional Guidelines for Evaluating Organic and Inorganic Analytes (USEPA 1992a), Guidance for Data Usability in Risk Assessment (USEPA 1993), USEPA CLP Statement of Works for Organics and Inorganics Analyses (USEPA 1991a, 1991b), and Gradient Corporation's professional judgment. Qualifiers were applied to the data during the data usability assessment to flag these uncertainties. Data rejected (qualified "R") are unusable because the level of uncertainty in the value is unacceptable as a basis for

project decisions. Overall, 1.2 percent of the soil data, 0.8 percent of the aqueous data, and 5.8 percent of the aqueous dissolved metals data were rejected.

Overall the data quality objectives (DQOs) for completeness as defined in the QAPP were achieved and the data reported were of good quality. A detailed summary of the data usability assessment is provided in Appendix J.

3.10 DATA EVALUATION METHODS

In the absence of site-specific, risk-based criteria, analytical data for soil and groundwater samples collected during the Phase IA RI have been evaluated on a preliminary basis by comparing the concentrations to the NJDEP cleanup criteria, guidelines, and standards for these media. The following sections discuss the purpose and application of these criteria.

3.10.1 NJDEP Soil Cleanup Criteria

Analytical data collected for soils have been compared to the most recently developed "Soil Cleanup Criteria," published and distributed by the NJDEP on February 3, 1994. These criteria were derived from Tables 3-1 and 7-1 and the accompanying text of the Proposed New Rule, New Jersey Administrative Code (NJAC) 7:26D published in the New Jersey Register on February 3, 1992. These criteria are included in the appropriate analytical data tables in this report to facilitate comparison.

3.10.1.1 Non-Residential Direct Contact Soil Cleanup Criteria

The NJDEP has developed surface soil cleanup criteria based on assumptions of long-term contact between a human receptor and the contaminated soils. Separate criteria have been established for residential and non-residential settings. Surface soil cleanup criteria were established to reduce the risks associated with chronic ingestion and/or inhalation of relatively small amounts of soil. Because the Site is located in an industrial zone, is used for industrial operations



and its use is limited by a deed restriction, the Non-Residential Direct-Contact Soil Cleanup Criteria (non-residential criteria) are more applicable for screening the soil results. However, for characterization purposes, detected analyte concentrations are also compared to the Residential Direct-Contact Soil Cleanup Criteria (residential criteria).

3.10.1.2 Impact to Groundwater Soil Cleanup Criteria

Subsurface Impact to Groundwater Soil Cleanup Criteria were developed by the NJDEP to protect groundwater quality in areas where groundwater is an actual or potential potable drinking water source. These criteria are based on assumptions regarding the rate at which contaminants will potentially leach to groundwater. For example, the criteria established for VOCs are based on a model that predicts the percentage of contaminants that may leach to groundwater over a 70-year period, while criteria developed for SVOCs were developed using a ranking system that considered solubility, biodegradability, and toxicity.

Additional criteria established by the NJDEP and used in this Phase IA RI Report to evaluate soil conditions at the Bayonne Plant included the 10,000 parts per million (ppm) guidance for total organic contamination, which includes TPH, and the 1,000-ppm guidance for total VOC contamination. Analytical TPH data were also compared to the criterion of 30,000 ppm for defining New Jersey hazardous waste when soil is excavated.

3.10.2 Total and Hexavalent Chromium Cleanup Criteria

For the purposes of conducting the chromium IRM investigation at the Bayonne Plant and of establishing which areas of the plant require IRMs, a site-specific action level of 500 ppm for total chromium in soil was established in discussions between Exxon, NJDEP, and ICF Kaiser Engineers, Inc. (ICF Kaiser Engineers, Inc. 1993). The NJDEP has published suggested soil cleanup criteria for chromium (NJDEP 1995a). A residential soil cleanup criterion of 78,000 ppm is suggested for trivalent chromium and the NJDEP recommends that trivalent chromium not be regulated in a non-residential situation. The NJDEP-suggested values, based on human health



inhalation exposure, for hexavalent chromium are: 130 ppm for residential use and 190 ppm for non-residential settings. Other suggested guidance values for hexavalent chromium are 10 ppm based on dermal exposure risk and 15 ppm for protection of groundwater.

Because the final levels upon which decisions regarding chromium will be based are not established, comparative criteria for total and hexavalent chromium in soils were established for use in this report. The criteria established for this report encompass all but the highest NJDEP suggested guidance values. A comparative criterion of 10,000 ppm was used for total chromium. Comparative values of 100 ppm and 10 ppm were used to evaluate hexavalent chromium concentrations in soil.

3.10.3 NJDEP Groundwater Quality Standards

In January 1993, the NJDEP promulgated the Groundwater Quality Standards (NJAC 7:9-6), which classified groundwaters of the state based on their potential for use for drinking water supply and their ability to support sensitive ecosystems. These regulations established numerical standards for the groundwater classification that pertains to most of the state. Laboratory analytical data for groundwater samples collected from the shallow intermediate and deep overburden were evaluated by comparing concentrations to the NJDEP groundwater quality standards. However, groundwater on portions of the Site may be amenable to reclassification based on high natural concentrations of iron and manganese, which render it unusable for drinking water.



4. PHYSICAL SETTING

This section provides a general description of the site-wide physical setting and prevailing hydrogeologic conditions at the Bayonne Plant. It includes a description of topography and drainage, land use, climate, soils and vegetation, geology, and hydrogeology.

4.1 TOPOGRAPHY AND DRAINAGE

The Bayonne Plant is located in the portion of Bayonne known as Constable Hook, which can be described as a spit or peninsula protruding into Upper New York Bay (Figure 1-1). The topography in the Constable Hook area is gentle, with elevations ranging from 0 to about 25 feet above mean sea level (msl). Most of the Site is at an elevation of 10 to 15 feet above msl, with the exception of the shoreline, which has lower elevations, and the tops of the berms surrounding the tank fields, which have higher elevations.

Under natural, undisturbed conditions, direct runoff from the Site would drain directly into Upper New York Bay or the Platty Kill Canal and Kill Van Kull Waterway. However, under current conditions at the Site, precipitation in the tank field areas does not run off directly because of the spill containment berms. Most of the Site is graded to direct runoff into the sewer system, which flows to the East Side Treatment Plant, treated water ultimately being discharged near the confluence of the Kill Van Kull and Upper New York Bay (Figure 3-1) under New Jersey Pollutant Discharge Elimination System (NJPDES)-Discharge to Surface Water (DSW) Permit No. NJ0002089. Only precipitation falling at the extreme perimeter of the Site (e.g., the undeveloped area immediately east of the General Tank Field), adjacent to the waterfront (riparian land), runs off directly into the adjacent waterways.

4.2 LAND USE

The Bayonne Plant is located in Hudson County, a 46-square mile urbanized area in northeastern New Jersey. The population density in Hudson County, as of the 1990 census, was 11,920 people per mile (Hudson County Department of Planning and Economic Development

1992). It is geographically the smallest and the most densely populated county in New Jersey. The general area surrounding the Site consists of heavy and light industry, interconnected by a transportation network of roadways, railroads, and the navigable waters of the Kill Van Kull and Upper New York Bay. Neighboring industries include petroleum and petrochemical companies, warehouses, distribution facilities, and various manufacturing operations. The closest non-industrial (commercial or residential) establishments are approximately 0.4 mile to the south across the Kill Van Kull Waterway in Staten Island, New York, and about 0.65 mile to the west along 22nd Street in Bayonne.

4.3 CLIMATE

Although greatly modified by the Atlantic Ocean, the climate of Hudson County is humid-continental. The climate is dominated by continental influences because air masses and weather systems affecting Hudson County have their origin principally over the land areas of North America. A maritime influence is also significant. Characteristics of the climate such as an extended period of freeze-free temperatures, a reduced range in both diurnal and annual temperature, and heavy precipitation in winter relative to that in summer are a result of the county's maritime exposure.

Periods of extreme cold are of short duration in most years. The average annual rainfall in the area is about 42 inches, as measured at Newark International Airport (National Oceanic Atmospheric Administration [NOAA] 1991). The average annual temperature is 53.4 degrees Fahrenheit (°F). The highest average monthly temperature occurs in July (76.8°F) and the lowest average monthly temperature occurs in January (31.3°F) (NOAA 1991). The predominant wind direction on a regional scale is from the west-southwest; however, localized flow patterns (eddies) do exist.

4.4 SOILS AND VEGETATION

Because of the extensive urbanization in Hudson County, no recently published information describing the soils in the area is available. A study conducted by researchers at Rutgers University (Lueder et al. 1952) describes the soil at the Site as reclaimed because of the extensive amount of filling that took place on Constable Hook to bring it to its present configuration. Historic aerial photographs confirm that a significant portion of the Site has been filled and reclaimed from Upper New York Bay and the Kill Van Kull Waterway. The extent of filling in the northern portion of Constable Hook can be observed on aerial photographs and historical maps dating back to 1940. However, much of the filling along the southern portion of the hook predates available aerial photographs. The nature of the fill varies across the Site and is described in more detail in Section 4.5.1 (Regional Geology).

The Site is sparsely vegetated due to the extensive industrial setting. Vegetation is limited to grasses and low-lying shrubs (native and ornamental), with occasional ornamental hardwood trees planted near the main building. More natural vegetation exists on the Site in limited undeveloped pockets adjacent to Upper New York Bay (e.g., the area to the east of the General Tank Field).

4.5 REGIONAL AND SITE GEOLOGY

This section provides a description of the regional and site-specific geology. Interpretation of the regional geology is based on information provided in regional or county-wide studies conducted by the USGS or other researchers as referenced below. Local geologic information has been interpreted by reviewing hundreds of logs of historical borings drilled across the Site for geotechnical purposes (e.g., foundation analysis for tanks and buildings) or monitoring and recovery well installation. The majority of the historical soil borings were drilled at the Site in the 1950s and 1960s. Historical borings and wells depicted on Figure 2-2 have been extensively evaluated by Geraghty & Miller, and the corresponding lithologic information has been put into a geographic information system (GIS) database. Information from 512 soil borings, 40 monitoring

wells, and ten recovery wells was compiled and is currently in the GIS database. In addition, lithologic information from soil borings and monitoring wells, installed in 1993 and 1994 as part of the ongoing NAPL IRM investigations, has been compiled.

4.5.1 Regional Geology

The Site is located in the glaciated portion of the Piedmont physiographic province, which is underlain by mostly late Triassic-age rocks. The Piedmont is characterized in New Jersey by a long and narrow fault-blocked basin bordered on the west by uplifted fault-blocked mountains. The eastern border of the Piedmont lies near Bayonne and Staten Island (Schubert 1968) and has been mapped by the Geological Survey of New York (1970) as running directly through Constable Hook. The Triassic-age rocks of the Piedmont include the sedimentary rocks of the Newark Basin Super group and intruded units of diabase and interbedded flows of basalt. The Triassic rocks comprise a sequence that attains a thickness on the order of 22,000 feet and dips generally northwestward; the sequence is locally faulted and folded. From northwest to southeast, or youngest to oldest, the sedimentary rocks include the Brunswick Formation, the Lockatong Formation, and the Stockton Formation (McGuinness 1963). More recent studies provide a more detailed stratigraphic sequence nomenclature within the Newark Basin Super Group. The Stockton Formation rests on the folded and extensively eroded metamorphic rock complex of the New York City Group. The sedimentary basin deposits are interlayered with extensive basaltic intrusive and extrusive rocks.

The Brunswick Formation has been reclassified as the Brunswick Group and is comprised of several sedimentary and volcanic formations (Olsen et al. 1989). The Passaic Formation (within the Brunswick Group) is the most abundantly exposed unit of the Newark Basin Super Group. It consists mostly of red shale, but includes sandstone beds that are thicker and more numerous in the northeastern part of the Newark Basin. The Lockatong Formation consists mostly of dark shales and argillites, but may include some thin-bedded sandstone or conglomerate. The Stockton Formation is mostly an arkosic sandstone and conglomerate.

The igneous deposits consist of either extrusive lava flows of the Watchung Basalt that are interbedded with the sedimentary rocks of the Newark Super Group, or the intrusive diabase of the Palisades, which forms a ridge of massive bedrock with a dark gray, mottled appearance extending from Rockland County, New York, through Hudson County, New York (west of the Site), and ending in Staten Island, New York. Based on regional mapping, the bedrock bordering the eastern extent of the Triassic deposits in the vicinity of the Site is either the Manhattan Formation, which consists principally of mica schist (Geological Survey of New York 1970) or a post-Ordovician serpentinite common to Staten Island (State of New Jersey Department of Conservation and Economic Development 1950). Geologic maps depicting bedrock for both New York and New Jersey show a geologic contact beneath the overlying unconsolidated deposits at the Site; however, the maps differ in their interpretation of the formations present. Both interpretations are consistent in that they hold that part of Constable Hook is underlain by crystalline metamorphic bedrock. A review of the historical boring logs indicate that under most of the Site, glacial till deposits are underlain by the Triassic-age (Newark Super Group) Stockton Formation, which is comprised primarily of arkosic sandstone and conglomerate. However, drilling activities did confirm the presence of the Manhattan Formation (Manhattan Schist) beneath the eastern portion of the Site.

Unconsolidated sediments deposited by glaciers or by glacial meltwater during the Pleistocene mantle the bedrock surface in much of the vicinity of Constable Hook. These deposits consist of clay, silt, sand, gravel, and boulders. Recent age deposits, primarily marine and near-marine sediments composed of silt, clay, and peat (where present), overlie the glacial sediments.

4.5.2 Site Geology

Previous soil investigations by various drilling and geotechnical engineering contractors provided hundreds of soil boring logs covering much of the Site. The Site History Report for the Bayonne Plant (Geraghty & Miller, Inc. 1994b) presented a summary of these historical borings. Based on shallow, intermediate, and deep subsurface borings drilled during this Phase IA RI, the geologic characterization of the Site as presented in the Site History Report has been refined. The significant modifications of the Site geologic characterization include the following: (1) a more



detailed characterization of the shallow deposits overlying the glacial till deposits, and (2) verification of a relatively consistent bedrock surface at approximately 100 feet bls directly overlain by a thick continuous layer of pre-glacial or interglacial alluvium (below the glacial till).

The generalized geology of the Site, from the surface downward, consists of the following five main stratigraphic units: (1) fill, (2) marsh deposits, (3) glacial till, (4) alluvium, and (5) bedrock. The stratigraphic units are classified based on the inferred depositional environment and the stratigraphic position of these units. Figure 4-1 shows the locations of hydrogeologic cross sections that illustrate the subsurface stratigraphy of the Site. Within each stratigraphic unit, subunits based on lithologic and hydrogeologic characteristics are also identified; these subunits are presented on the cross sections (see Figures 4-2 through 4-5). Abbreviations given in parentheses following soil descriptions in this section are designations from the United Soil Classification System.

4.5.2.1 Fill

The fill unit is the uppermost stratigraphic unit, extending across the entire Site. Fill material was used to modify site elevations, to provide structural support for foundations of tanks and other structures, and to reclaim parts of the Kill Van Kull Waterway and Upper New York Bay Shoreline. The fill unit varies from approximately 3 to 25 feet in thickness, and consists of a heterogeneous mixture of cinders, ash, clay, silt, sand, gravel, construction debris, and miscellaneous slag (F-M). In limited areas such as the coastal Piers and East Side Treatment Plant Area, the fill does not contain appreciable quantities of ash, cinders, or fine grained sediments, but is composed primarily of sand and gravel (F-SM). These more permeable sandy zones are found infrequently across the Site and appear both spatially and vertically discontinuous.

4.5.2.2 Marsh Deposits

The marsh deposits comprise a discontinuous, interlayered mixture of fine, medium, and coarse granular deposits. The marsh deposits include a thin (less than 1 to 4 feet), organic, fiber-

rich silt and clay subunit, referred to as the meadow mat (MM-PT), a more continuous alluvial subunit consisting of black organic silt and clay (AL-OL), and an organic, sandy clay with abundant plant fibers (MM-SP). Along the eastern coastline, a loose, organic silt subunit (AL-OL) extends into Upper New York Bay and is interpreted as an estuarine deposit.

4.5.2.3 Upper Alluvium

The upper alluvium is composed of four subunits that form a continuous, permeable unit underneath the marsh deposits. The upper subunit (AL-SW) is a gray to tan, very fine sand that varies in thickness from 0 to 18 feet. The thickest portion of this subunit fills an east-west buried stream channel that runs across the northern portion of the Site and has eroded to the underlying glacial till unit. The lower three alluvial subunits consist of red-brown, coarse-grained alluvial deposits (AL-SM, AL-SP, AL-GP) that become more coarse with depth and are interpreted as reworked glacial deposits or glacial outwash. Collectively, the lower three units vary in thickness from 0 to 19 feet.

4.5.2.4 Glacial Till

The glacial till unit generally consists of a densely compacted, red to brown deposit of poorly sorted clay, silt, sand, and gravel (GT-GM). Three subunits can be differentiated based upon grain size and permeability characteristics. The upper subunit (GT-SM) is gradational with the overlying alluvium and is composed of red, silty sand or poorly sorted sand and clay. A very low permeability clayey silt (GT-ML) is interlayered with the more abundant GT-GM sediments across the site and usually forms the base of the glacial till unit. At one location, a dense, tan to red clay (GT-CH) overlies the other glacial till subunits and may have formed as a ponded lake deposit following the last glacial recession. The upper surface of the glacial till is variable and exhibits up to 35 feet of relief across the Site, much of which is due to past stream activity which eroded channels into the glacial till sediments. The channels were subsequently filled with upper alluvium or marsh sediments. The thickness of the glacial till unit varies from 19 to 71 feet, and the subunits form a continuous low permeability zone across the Site.



4.5.2.5 Lower Alluvium

A continuous layer of brown to red-brown, medium to coarse sand (AL-SW) underlies the glacial till layer to bedrock. This sediment is approximately 55 to 60 feet thick across the Site and was deposited prior to the last glacial advance.

4.5.2.6 Bedrock

Prior to this Phase IA RI, inconsistencies in the previously interpreted depth to bedrock on the historical soil boring logs were noted in the Site History Report (Geraghty & Miller, Inc. 1994b). These inconsistencies were attributed to variations in drilling techniques and effectiveness of subsurface penetration. The shallower depths to bedrock were suspected to be incorrect due to erroneous interpretation of inferred bedrock from drilling refusal at the top of the glacial till. To verify the depth to bedrock, four deep soil borings (Soil Borings PN1SB1, LOSB19, APSB7, and PESB3) were drilled across the Site during the Phase IA RI. These soil borings were converted into deep overburden Monitoring Wells GMW21D, GMW22D, GMW23D, and GMW24D, respectively. To confirm the presence of bedrock and to determine the bedrock lithology, bedrock core samples were obtained at these four locations. Soil boring logs and core logs are provided in Appendix B.

The deep borings confirmed that the shallow bedrock elevations inferred by previous workers were incorrect. The four deep borings encountered bedrock at a depth of approximately 100 to 125 feet bls. The actual depth to bedrock is similar to the deeper depths to bedrock reported in some historical borings on-site and at the adjacent IMTT property (Geraghty & Miller, Inc. 1994b). A relatively flat bedrock surface rather than a highly variable bedrock surface is more consistent with the erosion of the bedrock to a common base level during periods of lower sea levels. Bedrock recovered from the three deep borings on the western portion of the Site (Soil Borings GMMW-21D, GMMW-22D, and GMMW-23D) indicate that approximately 2 to 12 feet



of weathered red siltstone overlies competent red sandstone. This sandstone is interpreted as the Stockton Formation of the Newark Basin Super Group.

The bedrock recovered from deep Soil Boring GMMW-24D indicates that the eastern edge of the Bayonne Plant is underlain by bedrock composed of gray mica schist. This mica schist bedrock is interpreted as the Manhattan Formation of the New York City Group. This interpretation is consistent with regional mapping by the New York State Geological Survey (Geological Survey of New York 1970). A weathered rock horizon was not encountered; only competent mica schist bedrock was encountered in deep boring GMMW-24D. An unconformable contact between the Stockton and Manhattan Formations apparently underlies the Site.

4.6 HYDROGEOLOGY

This section provides a description of the regional and the site-specific hydrogeology.

4.6.1 Regional Hydrogeology

The major aquifer systems in the northeast New Jersey metropolitan area include the following: (1) glacial till deposits, (2) stratified drift, and (3) Triassic-age shales and sandstones of the Newark Basin Super Group. Sedimentary coastal plain aquifer systems, such as the Sayerville Sand Member and the Farrington Sand Member, are not present in the vicinity of the Site. The glacial till deposits are only permeable in limited areas; in most areas, these deposits do not form a significant water-bearing sequence. West of Constable Hook, the City of Bayonne is underlain by the intrusive diabase of the Palisades Sill. This diabase bedrock commonly outcrops along the northeast-trending ridge underlying Bayonne. East of the diabase ridge, the stratified drift deposits and Triassic-age sedimentary rocks that are present underlying Constable Hook are not used as a source of groundwater.

A November 1992 computer survey of NJDEP Bureau of Water Allocation files, which document major groundwater withdrawals (greater than 100,000 gallons per day [gpd], indicates



that no major withdrawals occurred within 4.5 miles of the Site (Geraghty & Miller, Inc. 1994b). According to Mr. James Monkowski of the City of Bayonne Health Department, there are no industrial, domestic, or public water supply wells within a 1-mile radius of the Site (Monkowski 1994). The USGS (McGuinness 1963) documented areas in New Jersey (including Bayonne, Linden, and Elizabeth) having groundwater quality problems as early as the 1960s. As of November 1992, 242 Comprehensive Site List cases were located within a 5-mile radius of the Bayonne Plant. In addition, 48 known contaminated sites are listed in the City of Bayonne (NJDEP 1994b). Known contaminated sites include Amerada Hess Terminal, Bayonne City Landfill, Bayonne Industries, Bayonne Terminals, Inc., ICI Americas, Inc., McGovern Trucking, Powell Duffryn, PSE&G, and White Chemical. Documented water-quality problems, the proximity to the saline near-shore environment, and the low yield of the subsurface deposits probably contribute to the lack of water supply development in the vicinity of Bayonne.

4.6.2 Site Hydrogeology

As discussed in Section 4.5.2 (Site Geology), six stratigraphic units have been identified at the Site. Based on the lithologic descriptions and hydrogeologic characteristics of these stratigraphic units, Geraghty & Miller has sorted these units into five hydrogeologic units. Three water-bearing units (shallow, intermediate, and deep) are separated by two confining layers (an upper leaky confining layer and a lower confining layer).

The uppermost water-bearing unit is the saturated fill deposits. Depth to groundwater ranges from 3.8 to 10 feet bls beneath the Site. The hydraulic characteristics of the fill are highly variable depending on the type of fill. However, the relatively thin saturated thickness (averaging less than 10 feet) and the variable lateral extent of more permeable fill results in limited groundwater withdrawal capacities. Shallow groundwater elevations range from 2.5 to 13.5 feet above msl. The base of this shallow water-bearing unit is most commonly defined by the upper leaky confining layer, which consists of the meadow mat and underlying marsh silt and clay unit. This confining layer is nearly continuous, with only a few limited areas that allow for hydraulic connection between the saturated fill and the intermediate water-bearing unit, which consists of the



marsh/alluvial sand unit that overlies the glacial till. Significant differences between the potentiometric head of the intermediate marsh/alluvial sand and the shallow water-bearing fill illustrate the effectiveness of the upper confining layer. Vertical hydraulic head data are discussed in Section 4.6.2.2 (Vertical Flow Gradients). Occasionally, at a few locations, all of the marsh deposits are absent and the fill is directly underlain by the glacial till confining layer. No intermediate water-bearing unit is present at these isolated locations.

The lower confining layer at the Site consists of the glacial till unit. This dense, laterally continuous and thick (19 to 71 feet) layer of poorly sorted glacial till effectively isolates the shallow and intermediate water-bearing units from the deep water-bearing unit. The deep water-bearing unit consists of the alluvial sand unit and, to a lesser extent, the underlying fractured bedrock.

4.6.2.1 Shallow Groundwater Flow

Water levels were measured in shallow monitoring wells at the Bayonne Plant on December 12, 1994; those data are presented in Table 4-1. On April 17, 1995, water levels were measured at all intermediate and deep monitoring wells and at selected shallow monitoring wells, as presented in Table 4-2. Water-level measurements confirm the existence of intermediate and deep hydrostratigraphic zones in the overburden. Water levels measured in shallow wells during low tide on December 12, 1994 were used to construct a contour map showing the configuration of the water-table surface (see Figure 4-6). Figure 4-6 illustrates multiple groundwater flow directions from four general areas of higher groundwater elevations (i.e., recharge areas or groundwater mounds) as described below. Shallower groundwater commonly flows in a radial pattern away from the recharge areas toward Upper New York Bay, the Kill Van Kull Waterway, and the Platty Kill Canal. Shallow groundwater elevations along the east and southwest portions of the Site are slightly below sea level during low tide, similar to the elevation of the nearby tidal surface-water bodies. Horizontal flow gradient calculations are summarized in Table 4-3.

The first groundwater mound (greater than 15 feet above msl) occurs in the northwest portion of the Site. In this area, a groundwater recharge ridge is present beneath the center of the



"A"- Hill Tank Field and extends to the east beneath the southwest corner of the No. 2 Tank Field (see Figure 4-6). This groundwater divide results in a northeast flow direction beneath the Main Building Area, the No. 2 Tank Field, and the eastern portion of the "A"- Hill Tank Field. This northeast component of groundwater flow may be induced in part by pumpage of the interceptor trench, which is oriented northwest-southeast along the Site boundary. Horizontal gradients for this portion of the Site range from 0.012 to 0.017 foot per foot (ft/ft). On the other side of this divide, groundwater flows to the southwest under the western portion of the "A"- Hill Tank Field. In the center of the Bayonne Plant, near the Exxon Chemicals Plant Area, groundwater flow is generally to the east.

The second groundwater (hydraulic) mound is present beneath the center of the Lube Oil Area, with radial flow to the west, southwest, south, and southeast (see Figure 4-6). Groundwater flowing to the west and southwest discharges to the Platty Kill Creek and Pier No. 1 on the Kill Van Kull Waterway, with horizontal gradients ranging from 0.11 to 0.016 ft/ft.

In the eastern portion of the Site, the remaining two mounds, which are linear in form, straddle a groundwater trough that trends west to east beneath the eastern portion of the Low Sulfur Tank Field (see Figure 4-6). The groundwater trough effectively captures all shallow flow beneath the Solvent Tank Fields and the Low Sulfur Tank Field, with a very shallow gradient toward Upper New York Bay. Horizontal flow gradients are steeper between the mounds and the north and south sides of the trough (0.007 ft/ft), but become gentler within the trough (0.002 ft/ft). Shallow groundwater flow beneath the General Tank Field is generally to the north and northeast, with a horizontal gradient of approximately 0.010 ft/ft.

The elongated mounds in the water table apparently represent recharge areas for shallow groundwater. These recharge areas may be caused by several factors, including the following: (1) surface drainage patterns that direct run-off to the recharge areas; (2) more permeable surface deposits at the recharge areas that promote infiltration; (3) infiltration of leakage from aboveground and/or belowground water utilities and from sewers; and (4) depression of groundwater elevations

in adjacent areas due to high permeability deposits, including backfill along sewers and utility trenches.

4.6.2.2 Vertical Flow Gradients

After the Phase IA RI intermediate and deep monitoring wells were installed and developed, two rounds of water-level measurements were made on April 17, 1995 from these wells and nearby shallow wells to provide data to evaluate vertical flow gradients. Table 4-2 presents the water levels measured on April 17, 1995. Due to the lateral distance (100 to 200 feet) between the nearest shallow well and the intermediate and deep well pairs, estimation of vertical gradients between the shallow and deeper water-bearing units was conducted in more qualitative terms. General trends can be determined with the existing data by comparing the interpolated shallow water levels shown on Figure 4-5 with actual deep and intermediate water levels. At Monitoring Well Cluster GMMW-23I/GMMW-23D near the center of the Site, the shallow groundwater elevation is approximately 9.5 feet above msl, which is approximately 6.5 feet higher than the groundwater elevation measured in Monitoring Well GMMW-23I. Therefore, there is the potential for a downward component to groundwater flow in this area. Comparison of shallow groundwater elevations with groundwater elevations in intermediate wells near the shoreline indicates that a slightly downward or horizontal potential exists near Monitoring Well GMMW-24I and a slightly upward potential exists near Monitoring Well GMMW-21I.

Table 4-4 presents a summary of the vertical gradient calculations for intermediate and deep well clusters. As indicated in Table 4-4, the vertical gradient is consistently downward between the intermediate wells and the deep wells in the each of the three well pairs. This represents a potential for downward flow; but downward flow from the intermediate to deeper zone is impeded by the intervening glacial till confining layer.



4.6.2.3 Tidal Influences

Table 4-1 presents product and water-level measurements made during two comprehensive rounds (during low and high tide) at shallow monitoring wells and surface-water measuring points on December 12, 1994. These measurements were made over 8 1/2 hours and included measurements made during a rising tide cycle. Water-level measurements at surface-water measuring points indicated tidal variations of 1.05 to 3.48 feet with an average tidal range of 2.65 feet. The variation of recorded surface-water levels is likely due to differences between the time of measurements and the peak tide, and to local variations due to wind, currents, and wakes from marine vessels. With the exception of a few shoreline areas, the groundwater elevations in shallow monitoring wells did not exhibit significant fluctuations with the tidal cycle. Shallow monitoring wells that exhibited a water-level rise of greater than 1 foot during the rising tide cycle on December 12, 1994 are located adjacent to the shoreline of the Platty Kill Creek, the Kill Van Kull, and the Upper New York Bay. Water-level fluctuations of less than 1 foot (and more frequently less than 0.10 foot) were recorded at the majority of the other shallow monitoring wells, including all wells in the inland areas of the Site. Thus, the tidal influence on the shallow water table is generally limited to areas within approximately 600 to 650 feet of Upper New York Bay (Piers No. 6 and 7), within 200 to 400 feet of the Kill Van Kull (i.e., Helipad and Pier No. 1 Area), and in the immediate vicinity (within 100 to 200 feet) of Platty Kill Canal. One exception to this generalization is the Tank 1066 area where tidal variations were evidenced further inland.

The tidal fluctuations of water levels in the intermediate and deep monitoring wells were evaluated using two rounds of water-level measurements made on April 17, 1995 during a falling tide cycle (see Table 4-2). Similar to the shallow wells, intermediate and deep monitoring well water-level fluctuations at well pairs near the shoreline (i.e., Monitoring Well Clusters GMMW21I/GMMW21D and GMMW24I/GMMW24D) exhibited water-level fluctuations of 2.30 to 4.84 feet that correlated with the tide cycle. The two inland well pairs (i.e., Monitoring Well Clusters GMMW22I/GMMW22D and GMMW23I/GMMW23D) exhibited water-level fluctuations of 0.90 foot or less, and typically the groundwater elevations increased during the



falling tide, demonstrating either no correlation with the tidal cycle or else a possible response, but with a time lag.



5.0 PHASE IA - FINDINGS

This section describes the findings of the Phase IA RI program at the Bayonne Plant. It presents a summary and discussion of the results of soil and groundwater sampling, including a summary of QA/QC data evaluation. Observations of hydrocarbons in soil and floating NAPL are described in the context of the Phase IA findings and also in terms of site-wide NAPL plumes and ongoing NAPL IRM programs.

This section is not intended to provide a comprehensive assessment of the inter-relationships between soil, groundwater, and floating NAPL in operational areas of the Bayonne Plant. These relationships are discussed in Section 6.0 (Overview of Constituent and Site Properties Affecting Fate and Transport) and Section 7.0 (Data Evaluation, Hypothesis Development, and Conclusions).

5.1 SOIL QUALITY

Soil samples were collected for analytical purposes at 83 soil boring locations and 15 separate monitoring well locations during Phase IA of the RI. Of the 98 locations at which soil samples were collected, 84 locations were selected specifically for the RI and the remaining 14 locations were drilled in connection with contemporaneous IRM study activities. A total of 183 TPH, 108 TCL VOC (plus miscellaneous compounds), 108 TCL SVOC, 105 TCL pesticides/PCBs, and 112 TAL parameters, and 181 total and 141 hexavalent chromium analyses was completed on these soil samples, not including QA/QC blanks and replicates.

The analytical results of all soil samples collected at the Bayonne Plant during the RI and contemporaneous IRM study activities are provided in Tables 5-1 through 5-6 for TPH, TCL VOCs (plus miscellaneous compounds), TCL SVOCs, pesticides/PCBs, and TAL parameters (hexavalent chromium), respectively. Tentatively identified compounds (TICs) were not included in the analytical data summary tables for VOCs and SVOCs. The interpretation, evaluation, and use of TIC data for the Bayonne Plant RI were not deemed



necessary, in accordance with a July 6, 1995 NJDEP guidance letter to Exxon (NJDEP 1995b) in connection with the Bayway Refinery RI. The quantifiable level of weathered TPH in soils is sufficient to characterize contamination at the Bayonne Plant. For screening purposes, the analytical results were compared to the following applicable cleanup guidance levels for soils at contaminated sites: (1) residential direct-contact soil cleanup criteria, (2) non-residential direct-contact soil cleanup criteria, and (3) impact to groundwater soil cleanup criteria. Analytical results for TPH were compared to the following criteria: (1) the NJDEP criterion of 10,000 milligrams per kilogram (mg/kg) for total organic compounds, and (2) the Construction, Maintenance, and Emergency Repairs Protocol (CMERP) criterion of 30,000 mg/kg, as shown in Table 5-1. Analytical results that exceed the non-residential direct-contact soil cleanup criteria or the impact to groundwater soil cleanup criteria are identified in Tables 5-2 through 5-5 and are discussed in the following constituent group summary sections. Results for total chromium and hexavalent chromium are provided in Table 5-6, with total chromium compared to the value of 10,000 mg/kg, and hexavalent chromium compared to values of 100 mg/kg and 10 mg/kg pending finalization of NJDEP guidance for chromium. Table 5-7 provides the minimum and maximum quantified concentration of constituents detected in soil and presents the number and percentage of samples with constituent exceedance(s) of the applicable cleanup criteria for the whole site and for individual areas. It also provides the geometric mean concentration for each constituent for the entire site. This methodology was selected over the arithmetic mean because the data distributions were not normal and frequently tended to resemble a log normal distribution. It may not be meaningful for all constituents. The number and distribution of data points should be evaluated when using this mean value for decision making.

In addition to the summary tables, five figures (Figures 5-1 through 5-4) that depict summary soil quality are presented. Figure 5-1 depicts the TPH analytical data and identifies locations at which soil samples have or have not exceeded the soil quality criteria of 10,000 mg/kg and 30,000 mg/kg. Figures 5-2 and 5-3 provide specific constituent exceedances of the non-residential direct contact and impact to groundwater soil cleanup criteria for TCL/VOCs,



TCL SVOCs, TCL pesticides/PCBs, and TAL inorganics in surface and subsurface soils. Chromium (total and hexavalent) exceedances are shown on Figure 5-4.

5.1.1 Summary of Field QA/QC for Soil Samples

The QA/QC measures for Phase IA soil samples were conducted according to the QAPP of the RI Work Plan (Geraghty & Miller, Inc. 1993a) and are consistent with NJDEP guidance (NJDEPE 1992a). Sample collection and handling procedures and QA/QC sample collection frequency are discussed in Section 3.9 (Quality Assurance/Quality Control) and in the RI Work Plan (Geraghty and Miller, Inc. 1993a). Analytical results for soil replicate samples and field blanks associated with the samples collected during the RI are summarized below and discussed in detail in Appendix J. In accordance with the NJDEP Field Sampling Procedures Manual (NJDEPE 1992a), trip blanks were not required for soil samples.

Field replicates were collected to evaluate the reproducibility of the sampling technique, the laboratory precision in analyzing samples, and the degree to which variability in the soil type affects the analytical result. Ten "blind" field replicate samples were collected at Phase IA soil sampling locations. Analytical results for the ten replicate soil samples indicate a good degree of repeatability for the overall analytical data for soil samples collected at the Bayonne Plant. Six of these samples were analyzed for TPH, TCL VOCs plus site-specific alcohols and additional compounds, TCL SVOCs, TCL pesticides/PCBs, TAL metals and cyanide, and hexavalent chromium. This list constitutes the "full suite" of analyses at the Bayonne Plant and will be referred to in this report as the "full suite" or "full parameters." Two of the replicates collected were analyzed for TPH, total chromium, and hexavalent chromium only. One replicate sample was analyzed for TPH only, and one replicate sample was analyzed for hexavalent chromium only. The analytical results for each replicate were compared against the results for its associated soil sample to verify that the reported values for each constituent did not vary by more than 100 relative percent difference (RPD) (USEPA 1992a).



The sample/replicate pairs exceeded the RPD limit of 100 for TPH in two soil samples, for some metals (chromium, zinc, arsenic, and lead) in three soil samples, for one pesticide in one soil sample, and for one VOC in one soil sample. These exceedances are discussed in detail in Appendix J. In these cases, the heterogeneity of the soil sample matrix probably effected the large difference in the analytical result between the sample and replicate. The soil samples collected at the Bayonne Plant exhibited the significant heterogeneity, which is common for filled industrial sites. Soil sample heterogeneity makes it difficult to replicate a sample. Therefore, differences in analytical results may not be indicative of laboratory precision, but instead may reflect the inherent variability of the soil matrix and the difficulty in homogenizing a soil sample. Samples selected for VOC analysis are not homogenized, thus creating the potential for greater heterogeneity. Analytical results for the ten replicate soil samples indicate a good degree of repeatability for the overall analytical data for soil samples collected at the Bayonne Plant.

Field blanks were prepared to evaluate the potential for cross-contamination. The field blank results were used to determine if the sampling tools or decontamination techniques affected the integrity of the analytical results for the samples collected in the field and also to check the laboratory-prepared analyte-free water. Twenty aqueous field blanks were prepared on days when soil samples were collected during the Phase IA RI at the Bayonne Plant. Nine of the 20 field blanks were analyzed for full parameters; four were analyzed for TPH, hexavalent chromium, and total chromium; four were analyzed for TPH only; one was analyzed for TPH and hexavalent chromium only; one was analyzed for hexavalent chromium and SVOCs only; and one was analyzed for hexavalent chromium only (some of these field blanks were associated with the re-sampling efforts for SVOCs and hexavalent chromium). PCBs were not detected in any of the non-aqueous field blanks associated with the soil samples. One field blank contained detectable concentrations of TPH and one pesticide; six contained detectable concentrations of VOCs (methylene chloride and acetone, which are common laboratory contaminants), and eight contained detectable concentrations of SVOCs (in seven of these, the only SVOCs detected were phthalates, a common sampling artifact). One field blank also contained three other base/neutral extractable organic compounds. Nine

field blanks contained detectable concentrations of various metals; one of these field blanks contained detectable concentrations of lead. However, none of the field blanks yielded elevated concentrations of the above constituents. A detailed discussion of the field blank results is provided in Appendix J.

Analytical results from field blanks and soil samples collected on the same day were compared. In all cases, detected constituent levels in the blanks were at least an order of magnitude less than the constituent concentrations in their associated samples. Therefore, Geraghty & Miller concluded that no significant cross-contamination of samples had occurred due to sampling activities or decontamination procedures.

5.1.2 Total Petroleum Hydrocarbons in Soils - Analytical Results

A total of 183 soil samples obtained from 98 soil borings and monitoring well locations was submitted for TPH analysis (see Table 5-1). For screening purposes, all concentrations of TPH above the NJDEP soil cleanup guidance level of 10,000 mg/kg for total organic contaminants and the 30,000 mg/kg CMERP criteria are indicated in Table 5-1. TPH was detected in all soil samples at concentrations ranging from 75.2 to 479,000 mg/kg. The NJDEP soil cleanup guidance level of 10,000 mg/kg was exceeded for 109 samples (60 percent) at 73 locations (74 percent). TPH was more frequently detected in subsurface soil than in surface soils, and at higher concentrations. Thirteen surface-soil samples exceeded 30,000 mg/kg, whereas 50 subsurface soil samples exceeded this criterion. Thirteen surface-soil samples had concentrations exceeding 10,000 mg/kg but less than 30,000 mg/kg, as opposed to 33 subsurface soil sample exceedances over this range.

Figure 5-1 illustrates the areas of the Site where TPH has been detected in soil at concentrations greater than 10,000 and 30,000 mg/kg. As shown on this figure, high concentrations (above 10,000 mg/kg) of TPH are present in soils over much of the Site. The highest concentrations of TPH (greater than 100,000 mg/kg) in soil were observed in the General Tank Field, the Lube Oil Area, the Main Building Area, and the No. 3 Tank Field. In



each of these areas, past practices are possible sources of these higher TPH concentrations. Separator bottoms were disposed in the area of the General Tank Field; separators were formerly operated in the Lube Oil and No. 3 Tank Field Areas; and storage tanks, pump houses, and sweetening stills were formerly located in the Main Building Area.

Detected TPH concentrations are attributable to historic activities throughout the Bayonne Plant's 120 years of operation. Some portion of the TPH in the soil may be attributed to the composition of the fill. Observations made during drilling and soil sampling indicate that the TPH detected at many locations is visually evident as stains and adsorbed liquid.

5.1.3 Volatile Organic Compounds in Soils - Analytical Results

Of the 183 samples analyzed for TPH, 108 samples (59 percent) from 75 locations were selected for VOC analysis. Table 5-2 presents the concentrations of VOCs in soil samples and, for screening purposes, indicates, in bold type and underlined, all concentrations of VOCs that exceeded the NJDEP non-residential direct-contact or impact to groundwater soil cleanup criteria. Figures 5-2 and 5-3 depict locations where VOC concentrations in soils were compared to the NJDEP non-residential direct-contact soil cleanup criteria and impact to groundwater soil cleanup criteria for surface soils (0 to 2 feet bls) and subsurface soils (greater than 2 feet bls), respectively. The most stringent of these criteria for VOCs is generally the impact to groundwater criteria, which the NJDEP based on empirical models of transport mechanisms.

VOCs were detected in eleven samples at seven locations at concentrations above the impact to groundwater criteria. Only one of the eleven VOC samples with concentrations above the impact to groundwater criteria also had concentrations above the non-residential direct contact soil cleanup criteria. For screening purposes, Table 5-2 also provides a tabulation of total TCL VOCs identified in soil samples during Phase IA, with total VOC exceedances in bold and underlined. Only one location (Soil Boring ECPSB2 at a depth of 10



to 12 feet bls) contained total TCL VOCs (plus miscellaneous compounds) at concentrations above the NJDEP soil cleanup criteria of 1,000 mg/kg for total VOCs. The locations where VOCs were detected above the impact to groundwater soil cleanup criteria are discussed below.

The following VOCs were detected in soil above the impact to groundwater cleanup criteria (the number of exceedances is in parentheses): benzene (2), chlorobenzene (5), and xylenes (4). Only chlorobenzene at one location exceeded the non-residential direct contact soil cleanup criteria.

Of the seven locations at which soil criteria were exceeded, only three locations were surface soils (0 to 2 feet bls), and none of these surface soils exceeded the non-residential direct contact criteria. All three surface soil exceedances for VOCs detected at the Bayonne Plant were in the No. 3 Tank Field (Soil Borings N3TFSB6, N3TFSB7, and N3TFSB8) where mostly gasoline or light naphtha products were stored. The constituent exceedances in surface soil were benzene, chlorobenzene, and xylenes. The benzene and xylenes exceedances in this area can be related to a historic spill of light naphtha (Geraghty & Miller, Inc. 1994b) but the chlorobenzene source is not known. However, chlorobenzene may be present due to operations in the neighboring Exxon Chemicals Plant Area.

Five locations exhibited subsurface soil concentrations above the applicable criteria. At three locations (Soil Borings ECPSB2, ECIRMB3, and APSB6), chlorobenzene was observed in subsurface soils above the applicable criteria. One of these locations (Soil Boring ECPSB2) also showed xylene exceedances. Similar to the surface soil exceedances, chlorobenzene was observed in proximity to the Exxon Chemicals Plant Area. Xylene was observed above the applicable criteria at Soil Boring GTFSB9 in the General Tank Field. The presence of xylene at this location can be attributed to former spills in the General Tank Field. At one other location in the No. 2 Tank Field (Soil Boring N2TFSB4), xylene in the subsurface soil cannot be attributed to a specific spill; however, this constituent is typical of refined petroleum products.



5.1.4 Semivolatile Organic Compounds in Soils - Analytical Results

Of the 183 soil samples submitted for TPH analysis, 108 samples (59 percent) from 76 locations were submitted for SVOC analysis. Table 5-3 provides the SVOC concentration results for soil samples, and, for screening purposes, also indicates SVOC concentrations in soil samples that exceeded the NJDEP non-residential direct contact or impact to groundwater soil cleanup criteria. Figures 5-2 and 5-3 depict locations where SVOC concentrations in soil exceeded one or both of the NJDEP soil criteria (the non-residential soil cleanup criteria, and the impact to groundwater soil cleanup criteria) for surface and subsurface soils, respectively.

SVOC concentrations in soil were detected above the applicable criteria in 40 samples at 34 locations. The following SVOCs were detected in soil above the applicable criteria (the number of exceedances is in parentheses): benzo(a)anthracene (11), benzo(b)fluoranthene (9), benzo(a)pyrene (36), benzo(k)fluoranthene (9), chrysene (2), dibenz(a,h)anthracene (15), indeno(1,2,3-cd)pyrene (4), naphthalene (2), pyrene (1), N-nitrosodiphenylamine (1), 1,2-dichlorobenzene (1), and 1,4-dichlorobenzene (1). All but three of these constituents (N-nitrosodiphenylamine, 1,2-dichlorobenzene, and 1,4-dichlorobenzene) are polycyclic aromatic hydrocarbons (PAHs). The non-PAH SVOCs were each detected above the impact to groundwater soil cleanup criteria and were observed at Soil Borings ECPSB2 and N3TFSB7, which are located in the Exxon Chemicals Plant Area and the No. 3 Tank Field Area, respectively. These constituents may have originated from smaller sources that released the VOCs observed in the same locations. Naphthalene was detected above the impact to groundwater criteria at two locations: one in the Solvent Tank Field and the other at the same location as the non-PAHs in the Chemical Plant.

The PAHs are generally observed above the non-residential direct contact soil cleanup criteria throughout much of the Bayonne Plant. The higher concentrations and densities of exceedances were observed in the Lube Oil Area (including the Stockpile Area), the Pier No. 1 Area, the Exxon Chemicals Plant Area, the AV-Gas Tank Field, parts of the Asphalt Plant,



and the No. 3 Tank Field Area. Other exceedances were found but were sporadic. The greatest number of exceedances was observed for benzo(a)pyrene, with 36 samples exceeding the non-residential soil criteria. Specific sources cannot be identified for observed concentrations of PAHs. PAHs are present in various hydrocarbon products and residues associated with several generations of operating refinery history and smaller concentrations of PAHs are possibly associated with the coal-derived cinders that were used for fill on Constable Hook. In general, the highest concentrations of PAHs are found primarily in former processing areas, with lower concentrations observed in long-term tank field areas; this pattern would be expected based on the derivation of PAHs. In general, the relatively higher concentrations of PAHs at the Site are in the subsurface soils, with the exception of Soil Boring ECPSB5 where benzo(a)pyrene was detected at 33,000 ug/kg. PAH concentrations are higher in the subsurface soils, possibly because surface soils have been reworked in the course of multi-plant reconstruction/service change activities and probably because TPH concentrations tend to be higher in subsurface soils. There are, however, 14 locations in which PAHs were detected above the applicable criteria in surface soils compared to 20 subsurface locations above the applicable criteria.

5.1.5 Pesticides and PCBs in Soils - Analytical Results

A total of 105 of the 183 soil samples (57 percent) collected at 75 locations at the Bayonne Plant was submitted for pesticide and PCB analysis during the Phase IA investigation. Table 5-4 presents all of the analytical data for pesticides and PCBs in soil samples collected during Phase IA, and, for screening purposes, also indicates concentrations that exceeded the non-residential and/or impact to groundwater soil quality criteria for pesticides/PCBs. Figures 5-2 and 5-3 depict locations where pesticides and PCB concentrations in soil exceeded one or both of the NJDEP soil quality criteria (the non-residential soil cleanup criteria and the impact to groundwater soil cleanup criteria) for surface and subsurface soils, respectively.



Only one surface soil sample throughout the Site, Soil Boring LAIRMB1, located in the Lube Oil Area, exhibited exceedances of the applicable criteria for pesticides in soil. The following constituents were observed above the non-residential direct-contact soil cleanup criteria: 4,4'-DDD, 4,4'-DDT, and dieldrin. 4,4'-DDD also exceeded the impact to groundwater soil cleanup criterion. Because this was the only location where pesticide exceedances were observed and it was in a surface soil sample, it is possible that this detection is a remnant of pest control. Exxon's flea, lice, insect, and tick (FLIT) pesticides were manufactured for a short period at the plant; however, this specific exceedance cannot necessarily be attributed to this operation (Geraghty & Miller, Inc. 1994b).

No PCBs were observed above the applicable criteria at the Bayonne Plant.

5.1.6 Metals and Other Miscellaneous Analytes in Soils - Analytical Results

A total of 112 soil samples collected from 75 locations was analyzed for TAL constituents (i.e., metals). At 97 locations, 141 surface and subsurface soil samples were collected for total and hexavalent chromium analysis. Table 5-5 presents the analytical data for metals detected in soil, and, for screening purposes, also indicates which metal concentrations exceeded the NJDEP non-residential direct-contact soil criteria for metals, for all depths. Samples from 47 locations (64 percent) exceeded the non-residential soil criteria for the following metals, not including chromium (the number of exceedances is in parentheses): arsenic (49), beryllium (4), copper (6), lead (22), nickel (1), thallium (4), and zinc (3). Table 5-6 provides a list of individual results for total and hexavalent chromium. Figures 5-2 and 5-3 depict the number of exceedances for metals concentrations in surface and subsurface soils, respectively; these concentrations were compared to the non-residential soil cleanup criteria. Currently, the NJDEP has not published impact to groundwater soil cleanup criteria for metals. For evaluation purposes, chromium results were compared to 10,000 mg/kg for total chromium results, and 100 mg/kg and 10 mg/kg for hexavalent chromium pending establishment of regulatory standards for chromium. Figure 5-4 depicts the number and areas of exceedances for chromium. Sampling for chromium was generally

not conducted in known chromium areas but was conducted to ascertain the extent to which chromium was present outside those areas.

49 of the 112 soil samples (44 percent) submitted for TAL metals analysis exceeded the 20 mg/kg applicable criteria for arsenic. Of the exceedances, 25 were between 20 and 40 mg/kg, 13 between 40 and 80 mg/kg, 3 between 80 and 120 mg/kg, and 8 greater than 120 mg/kg. Arsenic levels are above the criterion in both surface and subsurface soils. The highest concentrations were detected in the subsurface soil borings in the Exxon Chemicals Plant Area (Soil Boring ECPSB2), AV-Gas Tank Field (Soil Boring AGTFSB1), the Main Building Area (Soil Boring MBSB3), and the Asphalt Plant (Soil Boring N3TFSB2), and also in the surface samples at the No. 3 Tank Field (Soil Borings N3TFSB7 and N3TFSB8). Because arsenic was detected throughout the facility at concentrations not significantly above the applicable criterion, the arsenic may be related to the coal-derived cinders emplaced during historical operations, or to other background factors.

Lead has been observed above the applicable criterion in 22 of the 112 soil samples (20 percent) analyzed for TAL metals. Twelve of the exceedances (11 percent of the samples) at eight locations were detected at 1,000 mg/kg or more, compared to the criteria of 600 mg/kg. Nine of the 12 exceedances that exhibited concentrations of lead above 1,000 mg/kg were at five locations in the northwest part of the General Tank Field. The high lead concentrations in this area are likely derived from the historic disposal of lead-contaminated separator bottoms or possibly from former fire training operations in that area. Lead concentrations above 1,000 mg/kg were also observed in soil borings at the AV-Gas Tank Field (Soil Boring AGTFSB3), the Lube Oil Area (Soil Boring LOSB17), and the No. 3 Tank Field (Soil Boring N3TFSB9). The relatively high lead concentrations in the AV-Gas Tank Field is not unexpected, since AV-gas is leaded; it is uncertain why there are high lead concentrations in the No. 3 Tank Field or in the Lube Oil Area.

All other metals detected above the criteria were sporadically located throughout the Site. Copper was detected above the applicable criterion in five areas of the Bayonne Plant;

three times in the surface soils and three times in the subsurface soils. Thallium was also detected sporadically throughout the Site; however, it was only detected above the applicable criterion in subsurface soils. Zinc was detected above the criterion at two locations in the General Tank Field and was present where lead concentrations were also high.

Due to past filling activities, some emphasis was placed on soil sampling for total and hexavalent chromium. One hundred and eighty samples were analyzed for total chromium from 97 locations and 141 samples from 87 locations were analyzed for hexavalent chromium (Table 5-6). Twenty-nine samples (16 percent) exhibited quantifiable concentrations of both total and hexavalent chromium. Total chromium was not detected above 10,000 mg/kg. Hexavalent chromium was detected above 100 mg/kg in three soil samples (2 percent) and above 10 mg/kg in 16 soil samples (11 percent) (Figure 5-4).

The data provided in Table 5-6 do not suggest a bias in chromium concentrations when surface soil results are compared with subsurface results. Nine surface soil samples exceeded the hexavalent chromium criteria, while seven subsurface soil samples exceeded one or both of the comparative criteria for hexavalent chromium.

The deposits of chromium fill at the Bayonne property are being studied in more detail by ICF Kaiser Engineers as part of an IRM study.

5.2 SUBSURFACE HYDROCARBONS AT THE BAYONNE PLANT

This section describes the hydrocarbon/NAPL observations from the Phase IA RI field activities and the NAPL IRM study activities. The NAPL discussion focuses on the shallow water-table zone in which almost all the NAPL was encountered, with the exception of the NAPL observed in the intermediate water-bearing deposits adjacent to the Platty Kill Canal. A more detailed review of NAPL in the area adjacent to the Platty Kill Canal has been conducted by DRAI (Dan Raviv Associates, Inc. 1994b). Throughout this Phase IA RI report, reference is made to NAPL thickness or apparent NAPL thickness. In this report,



these terms are synonymous because they refer to the observed thickness of NAPL in a temporary well point or monitoring well under static conditions, which is generally significantly greater than the true thickness of NAPL on the groundwater table in the geologic formation. To determine "true" NAPL thickness in the subsurface deposits, further testing, such as baildown tests, is warranted.

5.2.1 Hydrocarbon Observations from the Phase IA RI and Contemporaneous IRM Soil Boring and Well Installation Program

Temporary well points were installed at 99 of the 116 soil borings to determine whether the hydrocarbons visible in soil were free to migrate and accumulate on the shallow water table. Table 5-8 presents the results of the well point program conducted during Phase IA of the RI. Temporary well points were installed at the 99 locations in response to the visible presence of hydrocarbon sheens, products, or residual materials in soil (see Table 5-8). The field and construction techniques used to complete the well points are described in Section 3.3 (Hydrocarbon Delineation - Temporary Well Point Program and Hydrometer Testing).

NAPL was identified at measurable thicknesses (greater than 0.01 foot) in 54 of the 99 (55 percent) temporary well points installed during the RI/IRM field activities. NAPL thicknesses of less than 0.1 foot were measured at 13 of the 54 locations (24 percent); thicknesses between 0.1 and 1 foot were measured at 22 locations (41 percent); and thicknesses greater than 1 foot were measured at 19 locations (35 percent). The maximum NAPL thickness, 8.29 feet, was measured at Soil Boring N3TFSB1, which is located in the southern portion of the No. 3 Tank Field.

Five of the IRM well point locations that contained measurable thicknesses of floating hydrocarbons were completed as monitoring wells. Measurements were subsequently collected at the newly installed wells (before and after development) for comparison with the earlier well point measurements. NAPL thickness measured in each monitoring well was



comparable to the measurement in the well point previously installed at the same location (see Table 5-8). RI monitoring wells were installed without temporary well points, but were monitored in a similar manner.

NAPL samples were collected from 16 temporary well points and four RI/IRM monitoring wells for specific gravity measurements using a hydrometer. NAPL samples were also collected from 38 pre-existing IRM monitoring wells; these results are discussed in Section 5.2.2 (Plant-Wide Overview). The results of the hydrometer analysis are presented in Table 5-9 and shown on Figure 5-5. The testing procedures are described in Section 3.3.2 (Hydrometer Testing). NAPL samples were not collected from every temporary well point location that contained NAPL; rather they were collected from a selection of temporary well points located throughout the Site, to provide areal information on the types of floating hydrocarbons. NAPL specific gravities ranged from 0.820 (a diesel fuel-range specific gravity) at Soil Boring AHTFSB1 (located in the northern portion of the "A"-Hill Tank Field) to 0.970 (a No. 6 Fuel Oil-range gravity) at Soil Boring ECPSB2 (located in the northern portion of the Exxon Chemicals Plant) and Soil Boring AGTFSB4 (in the AV-Gas Tank Field).

5.2.2 Plant-Wide Overview

Figure 5-5 presents the apparent thickness of NAPL measured at the Site during the RI/IRM field activities. This figure was prepared by using maximum well point-measured NAPL thicknesses in conjunction with the synoptic NAPL thickness information obtained during the low-tide groundwater/NAPL level measuring event conducted on December 12, 1994. NAPL specific gravity information was derived from hydrometer analysis on NAPL samples collected from 20 RI/IRM well point/monitoring well locations and also from NAPL samples collected at 39 pre-existing IRM monitoring wells. This specific gravity information is provided in Table 5-9 and also shown near the temporary well point or monitoring well locations on Figure 5-5.

Seventeen floating NAPL plumes (Plumes No. 1 through 17) were identified during the field activities associated with the RI/IRM, as summarized in Table 5-10 and shown on Figure 5-5. The plumes are enumerated on Figure 5-5. Only NAPL observed in at least two contiguous boring/well locations is designated and enumerated as a plume on Figure 5-5. The depicted shape of the NAPL plumes on Figure 5-5 was determined by evaluating the direction of shallow groundwater flow, the orientation of groundwater divides, and the specific gravity of the NAPL.

To facilitate a discussion of the NAPL findings and the relationship of NAPL to soil and groundwater contamination, the Site is discussed by operational area from east to west; in some instances, contiguous operational areas are grouped. NAPL findings are therefore described for ten areas at the Bayonne Plant. These areas are intended to provide a geographic/operational perspective for the evaluation of NAPL in this section and for the contaminant relationship evaluations provided in Section 7.0 (Data Evaluation, Hypothesis Development, and Conclusions). The following is a brief description of the NAPL plume areas, including apparent NAPL thickness/thickness range, specific gravity and type, potential sources, and other information obtained from recent IRM activities, such as gas chromatograph (GC) fingerprinting.

- Piers, and the East Side Treatment Plant and MDC Building Area

Three NAPL plumes (Plumes No. 1 through 3) have been identified in this area (Figure 5-5). The largest NAPL plume (Plume No. 1) in this area is a 850-foot long linear feature, oriented east-west.

No NAPL was measured at several wells located immediately south of the Plume No. 1, indicating that the plume is probably not very wide. Apparent NAPL thicknesses during the low-tide water-level measuring event ranged from 0.44 foot at Monitoring Well EB66R to 3.57 feet at Monitoring Well EB69 (see Table 4-1 and Figure 5-5). During past IRM activities, DRAI has measured apparent NAPL



thicknesses as great as 7 feet in this area. NAPL specific gravity results in this area are indicative of diesel/No. 2 fuel oil products (0.860 at Monitoring Well EB59) at the western end of the plume, and of the No.6 fuel oil-product (specific gravities of 0.990 and 0.991 at Monitoring Wells EB69 and EB62, respectively) at the eastern end of the plume. Lighter product-specific gravity obtained from NAPL samples from monitoring wells at the nearby Pier 6 and Low Sulfur Tank Field indicates that the Plume No. 1 is not related to these other occurrences of floating NAPL.

As part of the Pier No 7 NAPL IRM, NAPL fingerprinting was conducted; results indicated that there is a mixture of NAPL in this area ranging from heavily degraded gasolines and diesel products to "fresh" heavy fuel oil, No. 6 fuel oil, and high viscosity lube base stock (Dan Raviv Associates, Inc. 1995c). NAPL samples from the Pier No. 7 Area were submitted for chemical analysis, the results indicating the presence of benzene, chlorobenzene, and xylenes (Dan Raviv Associates, Inc. 1995c). The original NAPL source is unknown, but may be related to ASTs that were present near Pier 7 between 1921 and 1970, or to a former oil-water separator that operated in the area between 1932 and 1970 (Geraghty & Miller 1994b). Additional potential migration pathways include backfilled sewer and piping trenches.

Two relatively small NAPL plumes (Plumes No. 2 and 3) were identified to the north and south of Pier 6 (see Figure 5-5). Apparent NAPL thicknesses ranged from 0.16 foot in a temporary well point installed in Soil Boring PESTSB2 to 1.05 feet at Monitoring Well EBR18 (see Table 4-1). NAPL specific gravity measurements by Geraghty & Miller indicate that the NAPL is in the kerosene/lube oil range (specific gravities of 0.851 and 0.852 at Monitoring Wells EBR71, EB72, and EBR18, respectively). DRAI obtained similar NAPL specific gravity results (0.851 to 0.854) for the Pier 6 area (Dan Raviv Associates, Inc. 1995b). The Pier 6 area has been a marine terminal since the early 1900s, and most likely the source of the NAPL is from historical spills (Dan Raviv Associates, Inc. 1995b).



Temporary well points installed by Geraghty & Miller during Phase IA of the RI in locations to the west north and south of Plumes 2 and 3 indicated that they are isolated and is not contiguous with the nearby Pier 7 (Plume No. 1) and Low Sulfur Tank Field plume (Pier No. 4).

- **Low Sulfur and Solvent Tank Fields**

A relatively large NAPL plume (Plume No. 4) is present in this area (Figure 5-5). The plume is centered in the vicinity of Tank 1066, and extends to the northwest toward Tank 1026, to the southeast toward Tank 1068, and to the east toward Tank 1035. NAPL thicknesses ranged from 0.51 foot at Monitoring Well EB81 to 13.6 feet at Monitoring Well MW8, located at the northeastern plume edge (see Table 4-1). Two types of NAPL appear to be present in this area. NAPL specific gravity measurements from various NAPL samples in the area indicate primarily a light product (specific gravity of 0.780 to 0.807). GC fingerprinting analyses of the NAPL in this area confirms that the NAPL has gasoline and kerosene characteristics. Analytical results of NAPL samples indicated that benzene, toluene, ethylbenzene, and xylene (BTEX), and naphthalene, PAHs, and lead are the major constituents present in the NAPL. This NAPL layer has been observed floating on the water table in this area since 1980. The source of this NAPL is likely to be from historical spills that occurred prior to 1967 when gasoline was stored in former ASTs in this area (Geraghty & Miller, Inc. 1994b).

A smaller, more localized pocket of heavier NAPL was observed in the vicinity of Tank 1066. This NAPL has a specific gravity of 0.990 and is indicative of a heavy fuel oil, such as No. 6 fuel oil or catalytic cracking fractionator tower bottoms (see Table 5-9). This NAPL was described as a viscous dark brown to black material (Dan Raviv Associates, Inc. 1993a). The source of this NAPL may be related to a historical release that occurred from Tank 1066 (Geraghty & Miller, Inc. 1994b).



- **General Tank Field**

Two floating NAPL plumes (Plumes No. 5 and 6) are defined within the General Tank Field, not including the portion of Plume No. 1 in the southeast corner of the tank field that extends into the area from the Piers and East Side Treatment Plant Area (see Figure 5-5). The first plume (Plume No. 5) is located in the north-central portion of the tank field, where one temporary well point (Soil Boring GTFSB2) and one Phase IA monitoring well (Monitoring Well GMMW10) showed floating NAPL in the range of 0.24 to 0.3 foot. The second plume (Plume No. 6) is located along the southern perimeter of the tank field, where temporary well points at Soil Borings GTFSB8 and GTFSB9 showed 1.2 feet and 2.07 feet of floating NAPL, respectively. A NAPL sample from Plume No. 6 had a specific gravity of 0.960, which is characteristic of No. 6 fuel oil. The NAPL in the northern plume appeared to be visually similar (i.e., very thick, black, weathered NAPL). The NAPL observed in the General Tank Field is most likely the result of historical spills from former ASTs that were located in the area between 1925 and 1974 and potentially from a pump house that operated near Soil Boring GTFSB8 between 1925 and 1951 (Geraghty & Miller 1994b). The two plumes may be contiguous since there is a lack of data points between them (see Figure 5-5).

- **AV-Gas Tank Field and Domestic Trade Area (includes southern part of Interceptor Trench)**

One NAPL plume (Plume No. 7) has been identified in this area. This plume occupies most of the AV-Gas Tank Field and extends southward into the Asphalt Plant Area. NAPL thicknesses ranged from 0.20 foot in the northern portion of the Asphalt Plant at the temporary well point for Soil Boring APSB4 to 9.9 feet in IRM Monitoring Well ITMW1 (see Tables 4-1 and 5-8). NAPL specific gravities in the interior part of the Tank Field were 0.965 (at Soil Boring AGTFSB3) and 0.970 (at Soil Boring AGTFSB4). These specific gravities are indicative of lube



oils and No. 6 fuel oil products, and probably reflect historical spills from former ASTs (1932 to 1940), a former crude stills facility (1920 to 1930), or two historical oil-water separators (1940 and 1945); the tank field is currently used to store aviation fuel. Specific gravities obtained from NAPL samples at Monitoring Well ITMW1, located on the northern perimeter of the tank field and closer to the interceptor trench, indicated much lighter NAPL in this area, with a specific gravity of 0.830, which is in the diesel/aviation fuel range. The source of the light NAPL identified in Monitoring Well ITMW1 could be related to a diesel spill (amount unknown) that was discovered north of Tank 1014 in 1992 (Geraghty & Miller 1994b).

Considering the absence of floating NAPL in the upgradient well point and monitoring well locations that surround the AV-Gas Tank Field, the upgradient side of this NAPL plume is considered to be well defined. However, a performance evaluation conducted on the interceptor trench determined that the NAPL identified in IRM Monitoring Well ITMW1 is not being captured by the trench (Dan Raviv Associates, Inc. 1995a). DRAI has proposed additional monitoring wells to further evaluate the extent of the floating NAPL and the effects of the interceptor trench to the east (Dan Raviv Associates, Inc. 1995a).

- Asphalt Plant and Exxon Chemicals Plant (includes Utilities Area)

Two NAPL plumes (Plumes No. 8 and 9) have been identified in this area, not including Plume No. 7, which occupies most of the AV-Gas Tank Field and extends into the Asphalt Plant Area. The first and larger of the plumes (Plume No. 8) is located in the northwestern portion of the Chemicals Plant and Asphalt Plant Areas (Figure 5-5). Measured NAPL thicknesses ranged from 0.34 foot at historical Monitoring Well MW2 to 1.58 feet at the Phase IA temporary well point at Soil Boring ECPSB2 (see Table 5-8). NAPL samples collected from two of the temporary well point locations showed specific gravities of 0.968 and 0.970 at Soil

Borings EC2SB1 and ECPSB2, respectively. These specific gravities are indicative of a heavier (or weathered) hydrocarbon, such as a No. 6 fuel oil or asphalt.

The second plume (Plume No. 9) is located along the southern boundary of the Utilities Area and extends into the No. 3 Tank Field. Apparent NAPL thickness in this area ranges from 0.11 foot to 4.67 feet (see Tables 4-1 and 5-8). NAPL specific gravities ranged from 0.853 to 0.870, as measured in NAPL samples from Monitoring Wells GMMW5 and GMMW18. This range may be indicative of lube oil or No. 2 fuel oil. There are many potential sources of the NAPL identified in the central portion of the Site, including spills related to former ASTs, a spill from Tank 916 in the No. 3 Tank Field (discovered in August 1978, unknown product and amount spilled), numerous documented asphalt spills to the ground, and several documented spills of slop oil and various Exxon lube oil additives (with specific gravities between 0.88 and 0.89) in the Chemicals Plant Area (Scerbo 1995, Geraghty & Miller, Inc. 1994b).

- No. 3 Tank Field

One NAPL plume (Plume No. 10) was identified in this area, as depicted on Figure 5-5, not including Plume No. 9, which is described in the Chemicals Plant Area although it extends into the No. 3 Tank Field. Apparent NAPL thicknesses ranged from 0.41 foot to 4.81 feet (see Tables 4-1 and 5-8). NAPL specific gravities ranged from 0.830 to 0.841 as measured from NAPL samples at Monitoring Wells GMMW7 and GMMW16 (see Table 5-9). This range is indicative of a naphtha that was stored in the tank field (Bruzzi 1995) or a kerosene-range product. Temporary well points and soil borings completed between Plume Nos. 9 and 10 did not contain floating NAPL, indicating that these two plumes are distinct and separate. Potential sources of the NAPL identified in the No. 3 Tank Field include former ASTs that were in operation between 1921 and 1970 in the area east of



present Tank 921, a former oil-water separator located south of Tanks 902 and 903, and spills at Tank 920 (500 gallons of F540 [powerformer feed stock, light product similar to kerosene] in January 1988) (Geraghty & Miller, Inc. 1994b, Scerbo 1995).

- No. 2 Tank Field and Main Building Area (includes northern part of Interceptor Trench)

Two NAPL plumes (Plumes No. 11 and 12) have been identified in this area, not including the portion of the NAPL plume (Plume No. 13) that extends into the area from the "A"-Hill Tank Field (Figure 5-5). The two plumes represent two isolated areas of floating NAPL along the northern and eastern/southeastern portion of the Main Building Area near the interceptor trench (see Figure 5-5).

In the northern area (Plume No. 11), five IRM monitoring wells contained floating NAPL at thicknesses ranging from 0.1 foot at Monitoring Well EB42 to 2.87 feet at Monitoring Well EB36 (see Table 4-1). Specific gravity measurements were performed on a NAPL sample from Monitoring Well ITMW4 and showed a specific gravity of 0.971, which is indicative of a heavy No. 6 fuel oil.

The second plume (Plume No. 12) is located north and east of the inter-refinery pipeline (IRPL) pump pad (see Figure 5-5). Three IRM monitoring wells and one Phase IA temporary well point location showed floating NAPL at thicknesses ranging from 0.11 foot at Soil Boring MBSB3 to 2.98 feet at IRM Monitoring Well ITMW2. Specific gravity measurements performed on a NAPL sample from Monitoring Well ITMW2 showed a NAPL specific gravity ranging from 0.866 to 0.870, which is characteristic of diesel or No. 2 fuel oil. These specific gravity values are similar to those obtained by DRAI during the Interceptor Trench NAPL IRM investigation (Dan Raviv Associates, Inc. 1995a).

The source of the heavy NAPL identified near the interceptor trench is most likely related to spills associated with historical ASTs that were in operation in the northern part of No. 2 Tank Field and extended into the AV-Gas Tank Field and Main Building Area between 1921 and 1970 or from sweetening stills that operated in this area, circa 1920 (Geraghty & Miller, Inc. 1994b). A performance evaluation completed on the interceptor trench in June 1995 indicated that the NAPL in the two areas defined above is being captured by the trench, either by natural gradients, or by pumping-influenced conditions (Dan Raviv Associates, Inc. 1995a).

- "A"-Hill Tank Field

One floating NAPL plume (Plume No. 13) has been identified in this area (Figure 5-5). The plume is centered on the "A"-Hill Tank Field and extends into the eastern portion of the Main Building Area (Figure 5-5). Five temporary well points installed in the "A"-Hill Tank Field and neighboring Main Building Area showed floating NAPL with similar NAPL specific gravities (see Figure 5-5). NAPL thickness in this area ranged from 0.11 foot at Soil Boring AHTFSB2, located in the northeastern portion of the tank field, to 6.56 foot at Soil Boring AHTFSB4, to 8.0 feet at Soil Boring MBSB2 located near the Main Building. Two NAPL samples obtained from well points installed within the tank field, and also from the well point installed near the Main Building, showed identical NAPL specific gravities of 0.820, which is indicative of a diesel-range product. IRM monitoring wells located on the up- and downgradient perimeter of the tank field have shown only trace amounts of floating NAPL, indicating that this NAPL is, for the most part, contained in the interior of the tank field.

Storage tanks that are still in operation in the "A"-Hill Tank Field currently hold heating oil. Historically, these tanks were known to contain heating oils and process gas oils. Two historical spills have been documented in this area, including



a 252,000-gallon spill of heating oil that occurred at Tank 514 in October 1978 and a 42,000-gallon spill of process gas oil (heavy feed stock for gasoline refining) that occurred at Tank 508 in February 1983 (Geraghty & Miller, Inc. 1994b). Process gas oil is stored in heated tanks, and considering that the spill was in February, it is likely that the spilled material congealed quickly and did not penetrate beyond the top few inches of soil. Accordingly, the heating oil spill is the probable source for Plume No. 13.

- Lube Oil Area and Stockpile Area (includes Platty Kill Canal)

Three NAPL plumes (Plumes No. 14, 15, and 16) have been identified in this area (Figure 5-5). One of the plumes (Plume No. 14) is located in the Lube Oil Area, and two are located in the Stockpile Area (Plumes No. 15 and 16). The first plume (Plume No. 14) is located in the northern part of the Lube Oil Area, to the east and northeast of Sub Station #18. This plume is defined by four historical monitoring wells and one Phase IA monitoring well containing floating NAPL. NAPL thicknesses ranged from 0.12 foot at Soil Boring EB24, located at the northern plume perimeter, to 0.77 foot at Monitoring Well GMMW1 located adjacent to the Blending and Packaging Warehouse. NAPL specific gravities for this plume ranged between 0.885 and 0.895, indicating a lube No. 2 oil-range product. The source of the floating NAPL in the northern portion of the Lube Oil Operational Area may be related to historical spills at two former pump houses (1932 to 1945) and at two tank car/tank truck loading racks (1932 to 1951) (Geraghty & Miller, Inc. 1994b). These facilities were located in the area between Monitoring Wells GMMW1 and EB24 (see Figure 5-5). A more likely source is the significantly damaged sewer which exists at the eastern edge of this plume. This sewer line formerly conveyed pumpage from the Interceptor Trench, which would have been water with small amounts of oil. This type of leakage could explain the large, but very thin plume observed in this area which has no apparent source area with greater NAPL thickness (Chapman 1995).



The Stockpile Area contains two shallow NAPL plumes (Plumes No. 15 and 16) in the unconsolidated fill/alluvium and a NAPL plume in the deeper, confined unconsolidated deposits (see Figure 5-5). Both of the shallow NAPL plumes extend to the east into the Lube Oil Area. Apparent NAPL thicknesses in the shallow plumes ranged from 0.11 foot at Monitoring Well GMMW12 in the northern plume to 3.23 feet in the temporary well point installed at Soil Boring LOSB8 in the southern plume (see Tables 4-1 and 5-8). NAPL specific gravities of 0.916 at the temporary well point at Soil Boring SSB-1 in the northern plume and of 0.907 at Monitoring Well EB19 in the southern plume are indicative of lube oil. Several historical oil-water separators (which operated between 1921 and 1959) located near Soil Boring LOSB1, lube oil spills at Tanks 106 and 107, and an existing loading rack could be the source or sources of the NAPL identified as Plume No. 15.

Three IRM monitoring wells completed in deeper, confined unconsolidated deposits also contained measurable amounts of NAPL. NAPL plumes in the intermediate zone are depicted on Figure 4-5. Apparent NAPL thicknesses in the deeper wells ranged from 0.75 foot at Monitoring Well PKMW14 to 9.34 feet at Monitoring Well PKMW11. NAPL specific gravity obtained from samples in the deeper wells were indicative of a lighter product (0.870 to 0.882). GC fingerprinting conducted on NAPL samples from Monitoring Wells PKMW11 and PKMW12 indicated that the NAPL is similar to jet fuel (Dan Raviv Associates, Inc. 1994b). Heavier product (a specific gravity of 0.920) was identified in one of the deep monitoring wells (Monitoring Well PKMW14), located at the northwestern edge of the plume. This observation may indicate a different source, and a potential mixing zone. A number of historical activities, as well as other unknown factors, may be sources of these plumes.

- Pier No.1 (includes Helipad Area)

During the synoptic low-tide groundwater level measuring event, a floating NAPL plume (Plume No. 17) was measured in many of the IRM monitoring wells located near the old No. 1 Pier and Helipad IRM areas (see Figure 5-5). Apparent NAPL thicknesses ranged from 0.19 foot at several monitoring wells in the southern and southeastern portion of this area to 4.18 feet at Monitoring Well EB12 (see Table 4-1). NAPL samples obtained from four IRM monitoring wells indicated specific gravities of 0.885 to 0.995. This range is indicative of a mixture of lube oils and heavier fuel oils, such as No. 6 fuel oil. Potential sources of the NAPL identified in the Pier No. 1 and the Helipad IRM area could be related to several loading/filling racks that operated near, north, and east of Monitoring Well EB12 between 1932 and 1945 (Geraghty & Miller, Inc. 1994b). The heavier NAPL (specific gravity of 0.995) was identified at Monitoring Well EB13, located at the western edge of the plume. NAPL samples collected as part of the Helipad NAPL IRM investigation indicate that the shallow NAPL is primarily composed of base neutral extractable compounds and benzene, toluene, and xylene (BTX) compounds.

This source may be related to two pump houses (No. 3 and No. 22), a loading rack, and former ASTs that were in operation between 1921 and 1951 in the area of the western portion of this plume (presently near Monitoring Wells EB6 and EB13) (see Figure 5-5). Monitoring wells completed in the deeper, confined unconsolidated deposits (Monitoring Wells GMMW21I and GMMW21D) did not contain floating NAPL, indicating that the NAPL observed in this area is confined to the shallow water-bearing zone. Temporary well points and/or soil borings completed along the property boundary to the east and at the southern edge of the tank field to the north did not contain floating NAPL. This lack of floating NAPL indicates that the plume does not extend onto adjacent property to the east and also does not extend significantly to the north. However, few data points are available to the west and northwest of the plume (see Figure 5-5).



A summary of the Phase IA RI findings with respect to the NAPL plumes discussed above, and a discussion of NAPL and contaminant fate and transport in the various plume areas, is provided in Section 7.0 (Data Evaluation, Hypothesis Development, and Conclusions) of this report.

5.3 GROUNDWATER QUALITY AT THE BAYONNE PLANT

A total of 48 groundwater samples, including associated QA/QC samples, was collected from monitoring wells and drivepoints at the Bayonne Plant as part of Phase IA of the RI. Groundwater samples collected from 31 monitoring wells were analyzed for TPH, TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, and miscellaneous inorganic parameters. In addition, groundwater samples collected from 13 temporary drivepoints were analyzed for TCL VOCs. Analytical results of groundwater samples for TPH, TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, and miscellaneous inorganic parameters are provided in Tables 5- 11 through 5-16. The number of groundwater samples from drivepoints is relatively small because NAPL was frequently encountered.

To evaluate constituent concentrations in groundwater underlying the Bayonne Plant, analytical results were compared to the NJDEP groundwater quality standards. This groundwater classification represents groundwater that is suitable for potable water use following treatment. As groundwater underlying Constable Hook is not used as a potable water supply, the application of these groundwater standards to the Bayonne Plant provides a very conservative comparison. A summary of the minimum and maximum quantified concentration of constituents detected in groundwater and the percentage of samples with constituent exceedances is provided in Table 5-17. Exceedances of the groundwater quality standards for organic compounds, metals, and inorganic constituents are shown on Figures 5-6 and 5-7. It also provides the geometric mean concentration for each constituent for the whole site summary section. This methodology was selected over the arithmetic mean because the data distributions were not normal and frequently tended to resemble a log normal



distribution. It may not be meaningful for all constituents. The number and distribution of data points should be evaluated when using this mean value for decision making.

The following sections provide a brief discussion of field QA/QC groundwater samples and laboratory analytical results by fraction.

5.3.1 Summary of Field QA/QC for Groundwater Samples

The QA/QC measures for Phase IA groundwater and drivepoint samples were conducted according to the QAPP, as provided in Appendix C of the RI Work Plan (Geraghty & Miller, Inc. 1993a) and are consistent with NJDEP guidance (NJDEPE 1992a). Sample collection and handling procedures and QA/QC sample collection frequency are discussed in Section 3.9 (Quality Assurance/Quality Control) and in the RI Work Plan (Geraghty and Miller, Inc. 1993a). Analytical results for aqueous replicate samples, field blanks, and trip blanks associated with the samples collected during the RI are summarized below and are discussed in detail in Appendix J.

Two field replicates were collected in conjunction with drivepoint groundwater sampling at the Bayonne Plant. Both replicates were analyzed for VOCs only, similar to drivepoint groundwater samples. The analytical results for each replicate were compared against the result for its associated groundwater sample to verify that the reported values for each constituent did not vary by more than 50 RPD (USEPA 1992a). Both sample and replicate pairs met the criteria.

Two field replicates were collected in conjunction with groundwater sample collections from monitoring wells at the Bayonne Plant. Samples and field replicates were analyzed for the full suite of compounds as well as miscellaneous inorganic parameters (such as BOD, COD, nitrate, sulfide, alkalinity, total phosphorus, sulfate, TDS, ammonia, organic carbon, and chloride) and dissolved gases (carbon dioxide, carbon monoxide, dissolved oxygen, methane, and dissolved oxygen). Both groundwater sample/replicate pairs exceeded

the standards for some metals and inorganic constituents. The analytical results from the field replicates associated with the Phase IA monitoring well and drivepoint groundwater sampling indicate that, both from an overall view and for the significant constituents, the analytical data from Phase IA water samples are precise.

Trip blanks were analyzed to determine if contamination was introduced into the sample during shipment or storage on-site. Field blank results were analyzed to determine if the sampling tools or decontamination techniques affected the integrity of the analytical results for samples collected in the field. The analytical results of each field and trip blank were compared to the results of all groundwater samples collected on the same day to identify constituent concentrations in the samples that were potentially raised above the NJDEP groundwater standards because of cross-contamination from the sampling containers, sampling equipment, field conditions, or filtering equipment.

Five field blanks and five trip blanks were prepared on days when groundwater samples were collected from monitoring wells at the Bayonne Plant. The field blanks were analyzed for the full suite of compounds that samples were analyzed for. The metals analyses were for the dissolved constituents only, except for cyanide, which was quantitated as total cyanide. Five samples were analyzed for both dissolved and total metals to satisfy NJDEP requirements according to the Field Verification Procedures and Analysis Plan (Geraghty & Miller, 1993b). The field blank associated with these samples was also analyzed for both dissolved and total metals. Trip blanks were analyzed for TCL VOCs plus site-specific compounds. Dissolved metals, phthalates, and common VOC laboratory contaminants were detected in all the field blanks at low concentrations, but these detections are not believed to have any significant effect on sample results. Two field blanks were reported with low concentrations of two pesticides, but these results did not impact the sample results. Acetone, methylene chloride, and chlorobenzene were detected in the trip blanks at low concentrations.

In general, the analytical data for field blanks and trip blanks prepared on days when groundwater samples were collected from drivepoints and monitoring wells at the Bayonne



Plant indicate that the data are useable and that no significant cross-contamination occurred during sampling activities or decontamination procedures.

5.3.2 Groundwater Sampling Laboratory Analytical Results

As part of Phase IA of the RI, a total of 48 groundwater samples was submitted to the laboratory for analysis. These samples included groundwater samples collected from 31 monitoring wells, 13 drivepoints, and four field replicate groundwater samples. Groundwater samples from 21 Phase IA monitoring wells and ten existing monitoring wells were analyzed for TPH, TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, and miscellaneous inorganic constituents. Groundwater samples from monitoring wells containing NAPL were not submitted for laboratory analysis due to the obvious presence of floating petroleum hydrocarbons. Analytical results of groundwater samples collected from monitoring wells were used to evaluate the groundwater quality in three different hydrostratigraphic zones. These samples consisted of the following: 24 groundwater samples from wells screened in the shallow overburden (primarily fill), three groundwater samples from intermediate overburden wells, and four groundwater samples collected from monitoring wells screened in the deep overburden, immediately above the bedrock.

5.3.2.1 Total Petroleum Hydrocarbons in Groundwater

Of the 31 groundwater samples collected from monitoring wells and analyzed for TPH, 30 of the samples (97 percent) exceeded the groundwater quality standard of 1 milligram per liter (mg/L) for TPH (Table 5-11). TPH concentrations in groundwater samples collected during the Phase IA RI are provided in Table 5-11.

All 24 groundwater samples collected from shallow overburden monitoring wells exceeded the groundwater quality criterion for TPH. TPH exceedances ranged from 4.25 to 121 mg/L in groundwater samples from shallow wells (Figure 5-6). TPH exceedances are widespread and are indicative of the long history, the site-wide refinery and petroleum storage



operations, and the permeable nature of the cinder fill materials used over significant areas of the Site. Seventeen of the 24 shallow groundwater samples had TPH concentrations ranging from 4.25 to 25 mg/L. The highest concentrations of TPH were reported in Monitoring Wells GMMW3, GMMW10, and GMMW15 at 42.1 mg/L, 121 mg/L, and 40.2 mg/L, respectively. The highest TPH concentrations were found in the vicinity of the General Tank Field, the MDC Building Area, and the Asphalt Plant Area (Figure 5-6).

TPH exceeded the groundwater quality criterion of 1 mg/L in the samples from the three intermediate monitoring wells (Figure 5-6). TPH concentrations of 1.85 mg/L, 3.37 mg/L, and 14.1 mg/L were reported in intermediate Monitoring Wells GMMW21I, GMMW23I, and GMMW24I, respectively.

TPH was detected in three of the four deep overburden monitoring wells sampled (Figure 5-6). Groundwater samples collected from Monitoring Wells GMMW22D, GMMW23D, and GMMW24D had concentrations of TPH slightly exceeding the groundwater quality criterion. TPH concentrations in these samples were reported at 1.1 mg/L, 1.15 mg/L, and 3.08 mg/L, respectively.

The relatively lower TPH concentrations detected in the intermediate and deep overburden monitoring wells compared to the TPH concentrations in the shallow zone may be indicative of one or more of the following: background groundwater quality, limited downward migration of petroleum hydrocarbons from the shallow zone, and interconnection between the surrounding waterways and the intermediate and deep hydrogeologic zones.

5.3.2.2 Volatile Organic Compounds in Groundwater

Of the 48 groundwater samples collected from monitoring wells and drivepoints and analyzed for TCL VOCs, 26 samples (54 percent) exceeded the NJDEP groundwater quality standards for one or more VOCs (Table 5-11). VOC concentrations in groundwater samples collected during the Phase IA RI are provided in Table 5-11. Thirteen VOCs exceeded the

groundwater quality standards in at least one sample. The bulk of the exceedances were for petroleum hydrocarbon constituents, such as benzene, chlorobenzene, and xylene. Benzene exceeded the groundwater quality criterion at a frequency of approximately 41 percent.

Of the 37 groundwater samples collected from shallow overburden monitoring wells and drivepoints, 19 samples (51 percent) exceeded the groundwater quality standards for VOCs. Exceedances were reported for one or more monitoring wells in the Lube Oil Area, Main Building Area, Exxon Chemicals Plant Area, Utilities Area, General Tank Field, Low Sulfur and Solvent Tank Fields (Tank 1066 area), and Pier No. 7 Area (Figure 5-6). In many of these areas, concentrations of dissolved benzene in the groundwater were located downgradient or in the vicinity of floating NAPL plumes. The greatest number of exceedances were for benzene, chlorobenzene, and xylenes. At Monitoring Well MW6, located immediately downgradient of the Low Sulfur Tank Field, 1,2-dichloroethene (1,2-DCE) and vinyl chloride were reported in exceedance of the NJDEP standards.

Groundwater samples collected from the three intermediate overburden monitoring wells at the Bayonne Plant exceeded the NJDEP groundwater quality standards for one or more VOCs. Benzene and 2-butanone (MEK) exceeded the groundwater quality standards in Monitoring Wells GMMW23I and GMMW24I, respectively (Figure 5-6). Benzene and several chlorinated VOCs were reported in Monitoring Well GMMW22I in the Pier No. 1 Area. These chlorinated VOCs were 1,2-DCE, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride. The source of these constituents is not known.

VOCs exceeded the NJDEP groundwater quality standards in groundwater samples collected from the four Phase IA deep overburden monitoring wells at the Bayonne Plant. Chloroform and/or bromodichloromethane exceeded the groundwater quality standards in Monitoring Wells GMMW22D, GMMW23D, and GMMW24D (Figure 5-6). Acetone exceeded the groundwater quality standards in Monitoring Well GMMW21D. The source of these VOCs in the deep overburden zone is not known.



5.3.2.3 Semivolatile Organic Compounds in Groundwater

Of the 31 groundwater samples collected from monitoring wells and analyzed for TCL SVOCs, six samples (19 percent) exceeded the NJDEP groundwater quality standards for one or more SVOCs (Table 5-12). SVOC concentrations in groundwater samples collected during Phase IA of the RI are provided in Table 5-12. SVOCs that exceeded the criteria consisted of 1,4-dichlorobenzene, naphthalene, 2,4-dimethylphenol, 2-methylnaphthalene, and pentachlorophenol. Naphthalene most frequently exceeded the groundwater quality criterion. SVOC exceedances for groundwater samples collected during the Phase IA RI are shown on Figure 5-6.

Of the 31 samples analyzed for TCL SVOCs, four samples from shallow monitoring wells exceeded the NJDEP groundwater quality standards. Naphthalene exceeded the standard in one monitoring well in each of the following areas: the Asphalt Plant Area, the No. 2 Tank Field, and the Low Sulfur and Solvent Tank Fields (Figure 5-6). 1,4-dichlorobenzene exceeded the standard in Monitoring Well GMMW3 in the Asphalt Plant Area. 2,4-Dimethylphenol and 2-methylnaphthalene exceeded the NJDEP groundwater standard in Monitoring Well MW10 in the Solvent Tank Field. 2-Methylnaphthalene exceeded the standard in Monitoring Well GMMW2 in the No. 2 Tank Field. These SVOCs were detected in the vicinity of floating NAPL plumes in the Asphalt Area and the Tank 1066 Area and may be associated with the dissolution of floating NAPL constituents into the groundwater.

Of the three groundwater samples collected from intermediate monitoring wells at the Bayonne Plant, one sample from Monitoring Well GMMW21I had a concentration of pentachlorophenol in exceedance of the NJDEP groundwater quality standards.

No SVOCs exceeded the groundwater quality standards in the four deep overburden monitoring wells.

5.3.2.4 Pesticides and PCBs in Groundwater

Of the 31 groundwater samples collected from monitoring wells at the Bayonne Plant, two samples (6 percent) exceeded the NJDEP groundwater quality standards for two pesticides (Table 5-13). No PCBs were detected in the groundwater samples collected as part of the Phase IA RI. Pesticide and PCB concentrations in groundwater samples collected during the Phase IA RI are provided in Table 5-13. Pesticide exceedances for groundwater samples are included on Figure 5-6.

A total of 24 groundwater samples from shallow monitoring wells was analyzed for pesticides and PCBs. Of the 24 samples, 4,4'-DDT was reported at a concentration of 0.12 micrograms per liter (ug/L) in a groundwater sample from Monitoring Well GMMW17 in the No. 3 Tank Field (Figure 5-6). No other exceedances were reported in groundwater samples from shallow monitoring wells.

One pesticide, alpha-BHC, was estimated at a concentration of 5 ug/L in a sample from one of the three intermediate monitoring wells, Monitoring Well GMMW21I (Figure 5-6). Pesticides did not exceed the groundwater standards in the other two intermediate monitoring wells.

Pesticides or PCBs were not reported at concentrations exceeding the groundwater quality standards in groundwater samples collected from the four Phase IA deep overburden monitoring wells.

5.3.2.5 Metals in Groundwater

Thirty-one groundwater samples were collected from monitoring wells at the Bayonne Plant as part of the Phase IA RI; these samples were filtered in the field and analyzed for TAL metals. The resulting data represent dissolved metals in the groundwater. In addition, five of the 31 groundwater samples (16 percent) were submitted to the laboratory in unfiltered form



to assess the relative concentration of total metals in groundwater. Iron and manganese were analyzed for total and dissolved metals for 27 of the 31 groundwater samples. Analytical results of total and dissolved metals in groundwater samples are provided in Tables 5-14 through 5-15. Exceedances of total and dissolved metals in groundwater samples are shown on Figure 5-7.

Of the 31 groundwater samples analyzed for TAL metals, 29 of the samples had exceedances of one or more dissolved metals (Figure 5-7). Iron and manganese were the most frequent exceedances of the NJDEP groundwater quality standards. Elevated concentrations of dissolved iron and manganese in almost all of the groundwater samples analyzed are likely indicative of background or regional groundwater quality conditions.

Twenty-four groundwater samples collected from monitoring wells screened in the shallow overburden were analyzed for TAL dissolved metals. Exclusive of the widespread exceedances of iron and manganese, 20 of the 24 samples exceeded the groundwater quality standards for one or more other dissolved metals. Dissolved sodium and/or aluminum exceeded the groundwater criteria in 16 of the 24 samples. These exceedances are probably indicative of background groundwater quality. Dissolved lead and arsenic exceeded the criteria at frequencies of approximately 6 and 23 percent, respectively. Dissolved lead and arsenic exceedances occurred in one or more shallow monitoring wells in the General Tank Field, Asphalt Plant, No. 2 Tank Field, Lube Oil Area, and Pier No. 1 Area (Figure 5-7). Dissolved chromium exceeded the NJDEP groundwater quality standards at three locations. These locations were Monitoring Well GMMW17 in the No. 3 Tank Field, Monitoring Well MW6 in the Low Sulfur Tank Field, and Monitoring Well EBR19 in the Pier No. 6 Area.

Shallow Monitoring Wells MW6 and EBR19 in the vicinity of the Low Sulfur Tank Field and Pier No. 6 areas revealed sporadic exceedances of additional dissolved metals (Figure 5-7). These additional metals consisted of antimony, beryllium, cadmium, cobalt, nickel, and verillium. The source of these miscellaneous metals may be related to the former Case & Can Plant, which was historically located in the MDC Building and Pier No. 6 Areas.



Groundwater samples collected from the three Phase IA intermediate wells at the Bayonne Plant exceeded the groundwater quality standards for the similar suite of metals reported in shallow overburden wells (Figure 5-7). Exclusive of iron and manganese, which were also elevated in the intermediate wells, there were exceedances for dissolved arsenic, sodium, and lead. Monitoring Well GMMW24I, in the Pier No. 6 Area, exhibited additional dissolved metals, specifically antimony, beryllium, cadmium, chromium, cobalt, and nickel.

Exceedances of one or more dissolved metals were reported in groundwater samples collected from the four deep overburden monitoring wells installed as part of the Phase IA RI. Two of the four monitoring wells exceeded the groundwater standards for dissolved iron and manganese. A groundwater sample from Monitoring Well GMMW21D exceeded the criteria for dissolved aluminum and sodium. Monitoring Well GMMW23D exceeded the groundwater criteria for dissolved sodium and arsenic.

5.3.2.6 Miscellaneous Inorganic Compounds in Groundwater

Groundwater samples collected from 27 monitoring wells during Phase IA of the RI were analyzed for miscellaneous inorganic compounds. Groundwater samples were collected from ten shallow Phase IA monitoring wells, ten existing shallow monitoring wells, three intermediate monitoring wells, and four deep overburden monitoring wells. Miscellaneous inorganic compounds consisted of various wet chemistry parameters and intrinsic biological parameters, which included dissolved gases. Concentrations of inorganic compounds for each of the groundwater samples analyzed are provided in Table 5-16.

Chloride concentrations in groundwater samples ranged from 5.47 to 11,300 mg/L. Approximately 11 of the 27 groundwater samples exceeded the groundwater quality standard of 250 mg/L for chloride. TDS concentrations in groundwater samples ranged from 106 to 4,630 mg/L. Approximately 11 of the 27 groundwater samples exceeded the NJDEP standard of 500 mg/L. Overall, approximately one-third to one-half of the Bayonne Plant exceeds the



criteria for both chlorides and TDS, as would be anticipated for a peninsular setting surrounded by the tidal estuaries of the Kill Van Kull and Upper New York Bay. However, these concentrations are not representative of Class III A groundwater. The minimum concentrations for Class III A groundwater are 3,000 mg/L for chloride and 5,000 mg/L for TDS.

Of the 20 groundwater samples collected from shallow monitoring wells, approximately ten samples (or 50 percent) had DO concentrations greater than 2 mg/L. DO data from shallow monitoring wells at the Bayonne Plant where NAPL and dissolved phase petroleum hydrocarbon constituents have been reported, indicate that site conditions are favorable for both aerobic and anaerobic biodegradation. Areas where groundwater has not been heavily impacted by organic contaminants tend to reflect moderate to high concentrations of DO. Case studies and the literature have shown that if sufficient DO (i.e., greater than 1 to 2 mg/L) is present in groundwater, aerobic biodegradation can degrade petroleum hydrocarbons at relatively higher rates than those achieved anaerobically (McAllister & Chiang 1994). Examples of such areas are Monitoring Wells EB29, EB1, and GMMW11. In areas of the plant that have sustained a higher degree of impact, the DO level has been depressed. Groundwater samples collected from intermediate and deep overburden wells generally yielded DO concentrations of less than 2 mg/L. When DO concentrations are depleted to less than 1 mg/L, anaerobic conditions prevail, and biodegradation of petroleum hydrocarbons can occur at relatively lower rates provided that nitrates, sulfates, or iron (ferrous iron) are available as electron acceptors. Examples of such areas are Monitoring Wells PKMW4, EBR13, and GMMW13, where DO levels are less than 1 mg/L. These monitoring wells are located in areas where floating NAPL and/or dissolved phase contaminants are present in groundwater.

Ammonia concentrations in groundwater samples range from 0.136 to 5.01 mg/L. The NJDEP groundwater quality standards for ammonia is 0.5 mg/L. Of the 27 groundwater samples analyzed, 15 samples exceeded the standard for ammonia.

Concentrations of sulfate range from 12.5 to 1,840 mg/L. Approximately 3 of the 20 groundwater samples collected from shallow monitoring wells exceed the NJDEP standard of 250 mg/L for sulfate. One of the three groundwater samples from intermediate wells, and three of the four groundwater samples from the deep overburden monitoring wells, exceeded the standards for sulfate. Concentrations of nitrate ranged from 0.063 to 3.2 mg/L. Nitrate concentrations were well below the NJDEP groundwater standard of 10 mg/L for nitrate. Nitrate and sulfate are electron acceptors that support the anaerobic biodegradation of contaminants. Concentrations of these analytes may be depressed as a result of anaerobic biodegradation processes. Examples of this are groundwater samples from Monitoring Wells MW6 and MW10, which exhibit relatively lower concentrations of sulfate and nitrate.

Certain anaerobic bacterial processes involved in the breakdown of organic compounds produce methane. Methane is commonly present in groundwater in reduced geochemical systems. Methane was detected in 16 of the 20 shallow monitoring wells sampled at concentrations ranging from 0.3 to 13.4 mg/L. Methane concentrations in groundwater samples from intermediate monitoring wells ranged from 0.3 to 3 mg/L, while methane was not detected in deep overburden monitoring wells.

TOC and COD provide a relative indication of the organic load to groundwater. COD values for groundwater samples from shallow monitoring wells ranged from 86 to 800 mg/L. TOC concentrations in the shallow zone ranged from 9.4 to 100 mg/L. Although the intermediate and deeper overburden zones indicate higher concentrations of COD, lower concentrations of TOC are manifested in these zones compared to the shallow overburden. Higher TOC in the shallow zone may be derived from organic contaminants in the shallow zone. Relatively higher COD in the intermediate and deep zones may be caused by anaerobic conditions that facilitate reduction of inorganic components in the water. These compounds may exert a high oxygen demand during COD analysis.

BOD₅ concentrations range from 6.4 to 74 mg/L for groundwater samples from shallow monitoring wells. Higher BOD₅ concentrations of 17 to 700 mg/L and 420 to 1,600

mg/L were reported for monitoring wells screened in the intermediate and deep overburden. The generally lower levels of BOD₅ in the shallow wells may be caused by the presence of elevated metals, potentially suppressing microbial activity of the test seed stock.

5.3.2.7 Field Parameters for Groundwater Samples

Field parameters were measured and recorded for groundwater samples from 25 shallow monitoring wells, three intermediate monitoring wells, and four deep monitoring wells during Phase IA of the RI. Measurement of field parameters was conducted concurrent with groundwater sampling activities on January 23 through January 27, 1995. Field parameters consisted of temperature, specific conductance, pH, DO, and redox potential. The parameters were recorded using a downhole probe, which was used to measure the parameters at approximately 2-foot intervals throughout the screened interval of each monitoring well. Measurement of the field parameters was conducted prior to and following monitoring well purging. Of the measurements recorded, the values recorded at the base of the water column in each monitoring well following purging were considered most representative of actual in-situ groundwater conditions. A summary of these field parameters is provided in Table 5-18. Additional field parameter data are included in Appendix O.

The temperature of the groundwater underlying the Bayonne Plant ranged from approximately 49 to 63 degrees Fahrenheit (°F). These temperatures are within the normal range for groundwater.

The pH for naturally occurring groundwater ranges from 6.0 to 8.5. The pH of groundwater underlying the Bayonne Plant was generally within this range. Lower pH values of 4.4 and 4.91 were measured in deep intermediate monitoring wells GMMW21D and GMMW22D. Higher pH values of 8.61 and 9.63 were measured for samples from shallow monitoring wells GMMW1 and GMMW2. Local variations in pH may be due to a number of factors, including oxidation reactions and to the aerobic biodegradation process, resulting in the production of carbon dioxide.



Specific conductance of groundwater is an indication of ion concentration. Specific conductance of groundwater samples collected from shallow, intermediate, and deep monitoring wells at the Site ranges from 100 to 9,280 micromhos per centimeter (umhos/cm). These values are similar to those for fresh to slightly brackish water. A typical specific conductance value for sea water is 50,000 umhos/cm. Local variations in specific conductance are likely to be due to variations in chloride, sulfate, nitrate, and hardness content.

DO concentrations of groundwater samples collected from shallow monitoring wells ranged from 0.39 to 11.73 mg/L. Approximately 15 of the 25 groundwater samples from shallow monitoring wells had DO concentrations of greater than 2 mg/L. Intermediate and deep overburden monitoring wells exhibited DO concentrations of less than 2 mg/L. Local variations in DO may be due to oxidation-reduction chemical reactions and/or may be indicative of active aerobic or anaerobic biodegradation processes. The field DO measurements are relatively consistent with those reported by the laboratory for groundwater samples.

Redox potential is a numerical index of the intensity of oxidizing or reducing conditions within a groundwater system. A positive value indicates a relatively oxidizing system, while a negative value indicates a relatively reducing system. Of the 25 shallow monitoring wells, 17 yielded negative values for redox potential. The three intermediate monitoring wells and two of the four deep overburden monitoring wells also indicated negative redox potential values. Thus, the results indicate that the majority of the shallow groundwater underlying the Site is under relatively reducing conditions, strongly implying that intrinsic bioattenuation processes are active at the Bayonne Plant. The intermediate and deep zones also appear to be reducing environments, perhaps because of the unavailability of oxygen in deeper zones.

6.0 OVERVIEW OF CONSTITUENT AND SITE PROPERTIES AFFECTING FATE AND TRANSPORT

Migration of the constituents detected at the Site is dependent on the physical and chemical properties of the constituents and the characteristics of the surrounding environment. This section discusses the composition of the petroleum hydrocarbons; the physical and chemical properties of the constituents; and the influence of those properties on the potential for migration in soil, groundwater, and air. This information will be used in the risk assessment to identify exposure pathways and to evaluate potential human health and environmental effects from exposure to the constituents of potential concern.

6.1 CHEMICAL STRUCTURE OF CONSTITUENTS DETECTED

The constituents detected in environmental media at the Site can be classified into several groupings. The basic groups are VOCs, SVOCs, pesticides/PCBs, and inorganics. Within each of these groups, the constituents can be classified into categories according to their similarity in chemical structure and/or physical-chemical properties (factors that influence mobility in the environment). The constituent categories and the constituents within each category that were detected at the Site at concentrations above the NJDEP non-residential and/or impact to groundwater soil cleanup criteria, and in groundwater above the NJDEP groundwater standards, are listed below. The metals shown with an asterisk in this list are those that were reported at concentrations of more than ten times the non-residential soil cleanup criteria.

- **Constituents in Soil**

- Monocyclic aromatics: Benzene, chlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and xylenes.
- PAHs: Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, and naphthalene.

- Amines: N-nitrosodiphenylamine.
- Pesticides: 4,4-DDD, 4,4-DDT, dieldrin.
- Inorganics: Arsenic*, beryllium, chromium, copper*, lead*, nickel, thallium, zinc, and chromium (although chromium does not have a cleanup criterion, its presence at the site warrants discussion).
- Constituents in Groundwater
 - Halogenated aliphatics: Bromodichloromethane, chloroform, 1,2-DCE, methylene chloride, PCE, TCE, and vinyl chloride.
 - Monocyclic aromatics: Benzene, chlorobenzene, 1,4-dichlorobenzene, ethylbenzene, and xylenes.
 - Ketones: Acetone and MEK.
 - PAHs: 2-Methylnaphthalene and naphthalene.
 - Phenols: 2,4-Dimethylphenol and pentachlorophenol.
 - Pesticides: alpha-BHC and 4,4-DDT.
 - Inorganics: Arsenic, antimony, beryllium, cadmium, chromium, cobalt, lead, and nickel.



6.2 PHYSICAL AND CHEMICAL PROPERTIES INFLUENCING CONSTITUENT MIGRATION

The environmental fate and transport of constituents are dependent on the physical and chemical properties of the constituents, the environmental transformation processes affecting them, and the media through which the constituents are migrating. This section will describe the primary physical and chemical properties that affect the fate and transport of the constituents. Key chemical and physical properties discussed in this section include water solubility, specific gravity, volatility, organic-carbon partition coefficient (K_{oc}), soil distribution coefficient (K_d), octanol-water partition coefficient (K_{ow}), and half-lives. Physical and chemical properties of the organic constituents are summarized in Table 6-1. The properties most often used to calculate K_d for organic constituents are the K_{oc} , which measures the selective affinity for soil organic carbon versus water, and the fraction of organic carbon (f_{oc}) in soil. In the absence of site-specific data, the K_d is expressed as the product of the K_{oc} and f_{oc} (USEPA 1989). The coal-derived cinders in the fill and the peat deposits under the fill at the Site are materials typically possessing relatively high f_{oc} values.

Solubilities of organic chemicals range from the low microgram per liter range to miscible, with most common organic chemicals having solubilities between 1 and 1,000,000 mg/L (Lyman et al. 1990). The ketones (acetone and MEK) are the most soluble constituents detected. The other VOCs are soluble, although to a lesser extent. The SVOCs tend to be less soluble; hence, there are fewer SVOCs detected in groundwater. None of the PAHs observed in soils, except naphthalene, was observed in the groundwater above the applicable NJDEP standards.

Organic compounds with Henry's law constants in the range of 10^{-3} atmospheres-cubic meter per mole ($\text{atm}\cdot\text{m}^3/\text{mol}$) and greater, and with molecular weights equal to, or less than, 200 grams per mole (g/mol) can be expected to readily volatilize from water (i.e., VOCs). Organic compounds with values ranging from 10^{-3} to 10^{-5} $\text{atm}\cdot\text{m}^3/\text{mol}$ are associated with possibly significant, but not facile, volatilization, while compounds with values less than 10^{-5} $\text{atm}\cdot\text{m}^3/\text{mol}$ will only volatilize slowly from water and to a limited extent. The VOCs, with the exception of acetone and MEK, are expected to volatilize from water. Most of the other constituents detected



are not expected to volatilize to an appreciable extent. Volatilization is the major removal mechanism from soil and surface water, and oxidation is the primary mechanism for atmospheric destruction of the monocyclic aromatic constituents.

The K_{ow} often is used to estimate the extent to which a constituent will partition from water into lipophilic parts of organisms, such as animal fat. Similarly, the K_{oc} reflects the propensity of a compound to adsorb to the organic matter found in soil or sediments. The bioconcentration factor (BCF) is the ratio of the concentration of the constituent in fish tissue to its concentration in water.

As a group, the VOCs have low values of K_{ow} , K_{oc} , and BCF, indicating a tendency not to partition to soil from water. The SVOCs (PAHs) have higher values of K_{ow} , K_{oc} , and BCF and have strong tendencies to partition to soil, depending in part on the organic matter content of the soils and available pathways. PAHs sorb strongly onto soil particles and are therefore observed in soils. Once sorbed to soil particles, mobility of PAHs is limited. In general, as the molecular weight increases, water solubility decreases. Biodegradation and biotransformation are the ultimate fate processes for PAHs in soil.

Adsorption potential typically is expressed in terms of a partition coefficient K_{oc} or K_d . Higher values of K_{oc} (greater than 10,000 milliliters per gram [mL/g]) indicate a greater potential for the constituent to adsorb to organic carbon in soil and aquifer materials. Constituents with low K_{oc} values (less than 1,000 mL/g) do not adsorb strongly to soil and aquifer materials (Ney 1990). Values of K_{oc} are shown in Table 6-1, and the values typically are based on several different types of studies or element-specific parameters. The VOCs are characterized by low K_{oc} s. These constituents do not tend to adsorb readily to organic soil or aquifer materials, and thus are characterized by high mobility in the environment. The other constituents, including the components of weathered petroleum hydrocarbon, are not expected to be as mobile as the VOCs. The occurrence of subsurface materials with high f_{oc} under most of the Site would tend to increase the K_d for all organic compounds and would reduce their mobility.

Persistence is a measure of the time constituents prevail in the environment and is commonly expressed in terms of half-lives ($T_{1/2}$) for specific environmental media. The half-life of

a constituent is the period of time required for one-half of the mass of a compound to be transformed into other constituents from the time of its introduction to the environment. Half-lives of the detected constituents are presented in Table 6-1 in ranges because the rate of degradation varies according to site-specific environmental conditions and concentration. Half-lives may be used to characterize the relative persistence of a constituent in various environmental media. The more persistent compounds detected at the Site include some of the PAHs [benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and pyrene] and the chlorinated aliphatics [TCE, PCE, 1,2-DCE, and vinyl chloride].

The inorganic constituents are not included in Table 6-1 because their properties are dependent on the form of the element. In soil, metals typically have very low mobilities, particularly under neutral or alkaline conditions. In addition, inorganic metal ions are not volatile. Metals in the soil tend to adsorb to soil particles, but may be desorbed when the conditions of the water moving through the soil are appropriate (primarily changes in pH and oxidation-reduction potential). Rain water is generally acidic due to the presence of carbon dioxide and industrial activity in the region. Therefore, the potential exists for inorganic constituents to migrate to some extent into groundwater. Once in groundwater, the inorganic constituents may be removed from the dissolved phase through reactions with ions of an opposite charge in the soil matrix. Since the inorganic elements do not degrade, the loss mechanisms are limited by such chemical interactions.

The mobility of inorganics depends on the soil bulk density, surface area, particle-size distribution, pH, redox status, ion exchange capacity, amount of organic matter, type and amount of metal oxides, and type and amount of clay materials. Soil pH is the property that most influences inorganic mobility. Cationic metals tend to be mobilized at low pH. The amount of organic matter, free iron oxides, and cation exchange capacity can significantly affect the amount of inorganics retained.

The K_d for inorganics provides a general indication of potential subsurface migration. Beryllium, chromium (as Chromium³⁺), lead, and thallium have high K_d values (650 to 1,500 mL/g) indicating relatively low mobility through soil. The K_d values for arsenic, hexavalent chromium,

copper, nickel, and zinc are lower (5 to 40 mL/g), indicating greater potential mobility. The different characteristics of the geologic strata beneath the Site result in different inorganic mobilities. For example, deposits of materials with relatively low hydraulic conductivities, such as cinders in the fill and the underlying marsh and related clay deposits beneath the Site, tend to reduce the mobility of inorganics. Because of the heterogeneity of the fill materials and the varying organic content of the subsurface deposits, it is very difficult to predict specific mobilities through the different deposits under the Site. However, a general discussion of the mobility of antimony, arsenic, beryllium, zinc, cadmium, chromium, cobalt, copper, lead, nickel, and thallium is provided in the following paragraphs.

Antimony is present as the oxide or antimonite salt in most natural waters. In reducing environments, volatile stibine (SbH_3), which is a gas at room temperature and quite soluble in water, may be formed. It is, however, unstable in aerobic waters or air and is oxidized to form the oxide. Sorption to clays is the most important mechanism, resulting in the removal of antimony from solution, thus reducing the aqueous transport of antimony.

Arsenic has many forms, but most commonly appears as anions in the environment. The most common forms are arsenite (H_2AsO_3^- or HAsO_3^{2-}) and arsenate (H_2AsO_4^- or HAsO_4^{2-}). Unlike the ten cations discussed above, ion exchange of arsenic in soil is limited, although some positively charged sites on soils can retard the migration of arsenic species. Also, adsorption of arsenic anions is increased and, therefore, mobility decreased at lower pH levels (that is, pH in the range of 3 to 7).

Beryllium (Be^{2+}) and zinc (Zn^{2+}) are divalent cations at low to moderate pH values in the environment. They do not form as many low solubility salts as lead; but as doubly charged cations, they undergo attenuation in soil through ion exchange reactions that are fairly strong. Beryllium is chemically similar to aluminum and therefore is expected to adsorb to clay particles. Zinc also complexes with clay, organic matter, and metal oxides.

Cadmium is found in the divalent (Cd^{2+}) state with pH controlling the speciation in water. Waters with pH values below 7 (acidic conditions) are more prone to leach inorganics. Higher pH values (basic conditions) usually result in decreased leaching potential and may also cause increased precipitation of metals as oxides and hydroxides. Cadmium is among the most mobile of the heavy metals, and its mobility depends more on sorption processes. Sorption of cadmium is influenced by the clay and metal oxide content of the soil and sediments.

Chemical speciation is critical in determining the fate and transport of chromium. Chromium in soil or water exists in either a trivalent (Cr^{3+}) or hexavalent (Cr^{6+}) oxidation state, depending on the presence of reducing agents. Hexavalent chromium is more commonly associated with residues from industrial processing of chromium and is soluble with adsorption to soil being an insignificant fate pathway. The presence of estuarine sediments can remove Cr^{6+} from solution by a two-step process: reduction of Cr^{6+} to Cr^{3+} followed by adsorption of Cr^{3+} to the sediments. Dominant fate processes of trivalent chromium include reaction with aqueous hydroxide ions to form an insoluble precipitate (chromium hydroxide) and adsorption of dissolved chromium to soil particulates and sediments. Consequently, migration of trivalent chromium is limited.

Cobalt is a relatively rare metal and its mobility is controlled by adsorption. This is governed by pH, redox potential, and concentration. Cobalt forms ionic chloride complexes in saltwater that are readily adsorbed to sediments. Elemental cobalt is otherwise relatively unreactive and is quite stable in water.

Copper, also a divalent cation (Cu^{2+}), is more immobile than lead. It does not form as many low-solubility salts, but through ion exchange, it is very strongly held to soil and organic matter particles. In addition, above approximately pH 7, substantial amounts of immobile solid copper hydroxide [$\text{Cu}(\text{OH})_2$] forms.

Lead is especially slow moving because of two important mechanisms. First, many salts of lead (for example, lead sulfate) have low solubilities; the presence of any number of negatively

charged ions (anions) in soil can result in the creation of immobile lead salts. Second, lead is a divalent cation (Pb^{2+}) and has a very high affinity for ion-exchange sites present on the surfaces of many soil fractions, including natural organic matter particles. This ion-exchange reaction will hold lead in place close to the source area. Soluble organic acids, such as might be found in the meadow mat, could increase the solubility of lead and other cations.

Nickel (Ni^{2+}) is usually found in the divalent state and forms salts with sulfate, chloride, nitrate, carbonate, oxide, hydroxide, and organic ligands. These salts are sufficiently soluble under aerobic conditions and pH below 9. Fulvic acid and humic materials, ubiquitous in natural soils and waters, increase the solubility of nickel, with adsorption processes being moderately effective in limiting the mobility of nickel.

Thallium (Tl^+) is a monovalent cation. Although its migration through soil is slowed somewhat by ion exchange, most ion exchange sites on soil and organic matter particles will prefer to react with divalent cations such as lead, copper, beryllium, and zinc, thereby leaving Tl in solution unless there is excess ion exchange capacity available. Thallium's metallic and covalent radicals are similar to lead and, therefore, it is expected to behave in a manner similar to lead.

For all 11 cations listed above, if soil conditions are reducing as is common at the Bayonne Plant, and sulfide (S^{2-}) is present, the mobility of the metals will be substantially lowered. All metal sulfides have extremely low solubilities in water.

6.3 COMPOSITION OF PETROLEUM HYDROCARBONS

TPH is an analytical method that quantifies concentrations of a complex mixture of petroleum-derived hydrocarbons. The hydrocarbons fall into four major classes, as follows: alkanes or paraffins (straight- or branched-chain hydrocarbons), cycloalkanes (ring structures), alkenes (carbon chains with one or more double-bonds), and aromatics (containing benzene-type rings) (Bergamini 1992).



When TPH enters the soil and/or groundwater, compositional changes referred to as weathering begin immediately. Volatilization of the lighter compounds occurs at a higher rate than that of heavier compounds, resulting in a shift in the composition of the weathered TPH toward heavier compounds. The solubilities of the heavier hydrocarbons are generally lower and the adsorption characteristics are stronger than those of the lighter compounds. Therefore, these heavier compounds tend to remain adsorbed to soil organic matter for longer periods of time, while the more soluble components partition into soil moisture and/or groundwater more quickly and more completely. Rates of biotransformation also are different; short-chain alkanes generally are biodegraded more quickly than aromatics, cycloalkanes, and heavier alkanes (USEPA 1989). The net result of these weathering processes is that the TPH concentrations reported from older, weathered product such as that encountered in parts of the Site will reflect a greater proportion of the heavier TPH components than fresh product. These heavier components are comprised largely of cycloalkanes and straight-chained and branched-chain alkanes (Andrews and Snyder 1991).

6.4 BIODEGRADATION OF PETROLEUM CONSTITUENTS AT THE SITE

Many of the petroleum constituents detected in soil and groundwater at the Site are susceptible, to varying degrees, to biodegradation by indigenous bacteria. Biodegradation of petroleum constituents in soil is primarily an aerobic process because of the availability of oxygen in soil pores. Biological and chemical processes occurring in soil can be important in determining the ultimate fate of the constituents in soils and groundwater at the Site. Microorganisms naturally occurring in soils are able to use numerous organic compounds as a food source, degrading the components ultimately to carbon dioxide and water (Kostecki and Calabrese 1989).

In most cases, an organic contaminant is not broken down completely to carbon dioxide and water by a bacterium, but is metabolized to an intermediate, which is, in turn, degraded further. The metabolites isolated depend primarily on the time at which the reaction is stopped.

The monocyclic aromatics (e.g., benzene) can be degraded aerobically (i.e., in the presence of oxygen) in soil (Kostecki and Calabrese 1989). In surficial soil, biodegradation can be relatively

rapid, provided adequate amounts of oxygen, moisture, and nutrients (e.g., nitrogen and phosphorus) are available. Aerobic metabolism of constituents under these conditions may result in the total depletion of oxygen. When this happens, the microorganisms may begin utilizing inorganic ions (such as nitrate or sulfate) as electron receptors and continue aerobic respiration, or other types of microorganisms may become active in metabolizing the constituents (USEPA 1989).

The PAHs also can be biodegraded. Factors contributing to the degree to which biodegradation occurs include biodegradability rates, production of intermediates, and the effects of mixtures. In general, smaller PAHs with two (e.g., naphthalene) or three rings (e.g., phenanthrene) are more readily degraded than larger PAHs (McKenna and Heath 1976).

In groundwater, biodegradation of petroleum constituents can proceed aerobically and anaerobically, depending primarily on the availability and replenishment of oxygen. In larger portions of the interior of the Site, it is likely that anaerobic processes dominate, as oxygen depleted by initial aerobic processes cannot be replenished by the slow groundwater flow rates to sustain aerobic degradation. Conversely, the alternative electron receptors needed for anaerobic degradation (sulfate, iron, manganese) are in abundant supply in Site groundwater and would be replenished at rates sufficient to sustain anaerobic degradation. In the near-shore zones adjacent to the Platty Kill Creek, the Kill Van Kull, and New York Bay, tidal flushing probably replenishes oxygen at rates sufficient to maintain aerobic degradation.

As described in Section 3.0 (Technical Overview - Investigation Methodology) and Section 5.0 (Phase IA - Findings), groundwater samples collected from selected monitoring wells were analyzed for a suite of organic and inorganic parameters that are indicators of the potential for, and the by-products of, aerobic and anaerobic degradation. The analytical results are provided in Table 5-16. The potential for aerobic biodegradation is determined primarily by the availability of DO and the redox potential; increases in carbon dioxide could be indicative of active aerobic biodegradation. Concentrations of these constituents are evaluated relative to background levels and/or pertinent references (McAllister and Chiang 1994; Wiedemeier et. Al. 1994) for assessing natural attenuation.

The potential for anaerobic degradation is determined by the availability of electron receptors such as sulfate, iron, and manganese. All of these are abundant in groundwater under the Site (Table 6-1). By-products of anaerobic biodegradation include methane, carbon dioxide, and sulfides (reduced from sulfate); the presence of elevated concentrations of these constituents could be indicative of active anaerobic biodegradation.

Background groundwater quality is probably reflected in Monitoring Wells EB-1 and EB-29, which had relatively high DO, little or no sulfide, no methane, and moderate to low carbon dioxide concentrations. Several monitoring wells appear to show evidence of anaerobic biodegradation; these monitoring wells are near the edges of NAPL plumes. These monitoring wells, which include Monitoring Wells GMMW3 (Asphalt Plant Area), GMMW9 and GMMW10 (General Tank Field), GMMW14, and MW10 (Solvent Tank Field) are generally characterized by elevated methane, carbon dioxide, and sulfide concentrations and negative redox potentials. These monitoring wells are also characterized by low or no concentrations of BTEX constituents (except for Monitoring Well MW10), which suggests that anaerobic biodegradation processes are destroying dissolved constituents emanating from NAPL plumes. More data are required to fully assess the extent of these processes around the margins of plumes, best obtained once NAPL removal measures are in effect.

6.5 MECHANISMS OF MIGRATION

There are several mechanisms by which constituents may migrate through environmental media at the Site. Migration into the air can occur via volatilization or fugitive dust emissions, and migration from soil into groundwater can occur by percolation of infiltrating rain water. Constituents can dissolve from NAPL bodies into groundwater. Dissolved constituents can be transported with prevailing groundwater flow. The mechanisms of migration are discussed in this section from a conceptual standpoint, together with a discussion of constituent persistence and transformations that may occur in the source or transport medium.



6.5.1 Migration into Air

The following two processes control migration of constituents into air: (1) Organic constituents may volatilize and migrate into the air; (2) constituents adsorbed to surface soil may migrate into the air through the generation of dust either by wind erosion in unpaved areas or by mechanical means. Constituents released into the atmosphere are subject to transport and dispersion by prevailing winds. Given the operations of the Bayonne Plant (i.e., well ventilated open areas), there is virtually no potential for volatilized constituents to present a risk to human health.

Fugitive dust emissions from wind or vehicle operations could occur from unpaved portions of the Site and during construction activities. During the entire 4-month field effort conducted for the Phase IA RI, dust monitoring was conducted; the results of the dust monitoring indicated that the dust generation at the Site was not a health concern to workers (see Appendix G). Constituents with relatively low organic carbon partition coefficients (K_{oc} values less than 1,000) and moderate to high water solubility (greater than 1 mg/L) are more likely to be associated with the water or vapor phases than to remain in soil and, therefore, are unlikely to be present in emitted dust. The VOCs fall into this category; therefore, these constituents are not expected to be emitted in dust. The heavier fractions of TPH, SVOCs, pesticides, and metals are expected to adsorb to soil and hence could be emitted as fugitive dust.

Most of the metals can form insoluble compounds with constituents found in soils or sorb onto soil particles. These processes will result in the inorganic compounds remaining in the soil. As a result, inorganic constituents could be transported by fugitive dust.

6.5.2 Migration in Soil

Solubility in water, area rainfall characteristics (which affect fluctuations in the groundwater levels), the tendency to bind to soil and organic carbon, the type of soil (particle size distribution, clay content, f_{oc} content, porosity, and permeability), and the depth to groundwater

are significant factors in determining the potential for constituents to be carried from soil to groundwater. The presence of the coal-derived cinders under much of the Site may tend to retard migration of constituents with high K_{oc} s. The more soluble constituents may migrate through soil to the groundwater with infiltrating precipitation. Typically, organic constituents with high water solubilities and low K_{oc} s are particularly susceptible to leaching. The more volatile constituents may migrate into air, as discussed in the previous section. In general, the pesticides, the PAHs, and the metals detected in soil are not very soluble or mobile.

The nature of the site soils significantly affects transport within the soil. Clays and certain minerals exhibit adsorptive behavior, while organic matter is capable of both adsorption and absorption. Coarse silica sands are very poor at sorbing chemicals. Because sorption is an equilibrium process, some of the sorbed constituents may "desorb" from the particles into the dissolved phase, be released into the soil moisture, and be transported with infiltrating precipitation. These dissolved constituents then may become sorbed to aquifer materials again, followed by dispersion by groundwater transport. The more mobile constituents are expected to be VOCs and the constituents with low molecular weight in the TPH mixtures, such as benzene.

The soils under the Site are composed of predominantly fine-grained fill materials with a high percentage of coal-derived cinders. The peat deposits under the fill have a high percentage of clay, silt, and organic matter, and will act to retard constituent migration.

The transport of the inorganic constituents through soil to groundwater is influenced by soil characteristics and water movement. Soil parameters to be considered are cation and anion exchange capacities (i.e., the interaction between positively and negatively charged ions), f_{oc} , pH, oxidation-reduction potential, porosity, and permeability. In general, inorganic constituents with a positive charge (cations) will be retarded (sorbed) by clays that exhibit an overall negative charge. Arsenic and chromium typically are often present as anions (e.g., arsenates and chromates) and will not be retarded by clay as readily as other metals.



6.5.3 Dissolution from NAPL

Depending on their chemical composition, the NAPL bodies delineated under the Site, can act as sources of dissolved constituents that can partition to groundwater. Heavier NAPL bodies, such as products that have specific gravities characteristic of lube oils and No. 6 fuel oil, do not contain constituents that are readily soluble. Lighter fuels, such as kerosene, gasoline, and naphtha, could be sources of dissolved constituents that could partition to groundwater, such as benzene, ethylbenzene, and xylenes, all of which have been detected in groundwater near NAPL bodies.

6.5.4 Migration in Groundwater

Transport of constituents in groundwater is expected to be a primary mechanism of transport of the lighter and more soluble constituents detected at the Site. Groundwater transport of organic compounds is controlled by many of the same processes discussed in Section 6.5.2 (Migration in Soil). Solubility and sorption are the most important constituent properties affecting leaching and groundwater transport. The moderate to high solubility values and low K_{oc} values of the halogenated aliphatics, monocyclic aromatics, ketones, naphthalene, and phenols detected in groundwater indicate that these constituents tend to dissolve and move with groundwater, and will adsorb to aquifer materials only partially, if at all. Constituents migrate in the subsurface primarily in the dissolved aqueous phase. TPH, PAHs, pesticides, and metals have low solubilities and tend to sorb to soils; they normally do not dissolve to appreciable concentrations nor migrate with groundwater over appreciable distances. Metals with a low K_d value (arsenic, copper, and zinc) are potentially more mobile, while those with a high K_d value (beryllium, chromium, lead, and thallium) will tend to be more immobile.

As soluble constituents are transported with groundwater, they are subject to various processes that can retard their migration or degrade them completely. The petroleum constituents and halogenated aliphatics will be retarded to some extent by adsorption on the fine-grained silt and clay that compose a large percentage of the fill, and by the carbonaceous compounds that make up the coal-derived cinders. Dissolved metals such as lead will also be retarded, given their potential



to adsorb to clay particles. As discussed in Section 6.4 (Biodegradation of Petroleum Constituents at the Site), there is evidence that biodegradation, particularly anaerobic processes, are destroying soluble petroleum constituents as they migrate with prevailing groundwater flow. Finally, given that groundwater is discharging ultimately to surface-water bodies, tidal flushing in near-shore zones will act to replenish oxygen at rates sufficient to maintain aerobic biodegradation, which would tend to destroy any residual concentrations of soluble petroleum constituents. This process will serve to reduce dissolved constituent concentrations before they can ultimately discharge to the Platty Kill Creek, the Kill Van Kull Waterway, or New York Bay.

7.0 DATA EVALUATION, HYPOTHESIS DEVELOPMENT, AND CONCLUSIONS

In this section, the distribution of contaminants in site media is analyzed, and the relationships between conditions in soil, floating NAPL, and groundwater quality are interpreted. This analysis and interpretation is based on the characterization of hydrogeologic conditions (Section 4.0 [Physical Setting]); contaminant distribution (Section 5.0 [Phase IA - Findings]); and the processes affecting contaminant fate and transport (Section 6.0 [Overview of Constituent and Site Properties Affecting Fate and Transport]).

A more detailed description of the relationships between soil quality, groundwater quality, and NAPL plumes is presented and organized geographically, consistent with the NAPL plume description in Section 5.0 (Phase IA Findings). Each area-specific description of relationships is followed by a discussion of area-specific contaminant fate and transport. NAPL plume areas with higher potential for requiring prompt remediation due to potential off-site impact(s) or other concerns are distinguished from those that are less significant because of their distance from site boundaries or their need for further characterization in Phase IB. Potential remedial technologies to remove or control the migration of floating NAPL are identified, and data gaps relative to the feasibility of potential remedial approaches for NAPL control/remediation are discussed on a site-wide basis. The primary focus of the discussion herein is NAPL removal, which is a priority not only to limit additional migration, but also because the presence of large amounts of NAPL limits characterization effectiveness for soil and groundwater.

7.1 SUMMARY OF FINDINGS

This section presents a broad overview of the analytical findings (soil and groundwater quality) and NAPL observations discussed in detail in Section 5.0 (Phase IA - Findings). To facilitate the discussion of analytical findings and NAPL observations, Table 7-1 has been prepared as a reference. All exceedances are listed in Table 7-1, but only the most important exceedances are discussed in this section. Constituents detected above the NJDEP non-residential direct contact or impact to groundwater soil cleanup criteria in both surface (0 to 2

feet bls) and subsurface (greater than 2 feet bls) soil are presented in Table 7-1. The numerical designations of the NAPL plumes observed on the water table, identified during the RI and IRM activities, and presented on Figure 5-5 and in Table 5-10, are included for each area in Table 7-1. Analytes detected in groundwater above the NJDEP standards or the interim generic groundwater quality criteria (IGGWQC) are also summarized in this table. The findings provided in Table 7-1 are presented for ten areas in the Bayonne Plant, the areas having geographic continuity and similarities in contamination characteristics. The areas discussed below are presented in order from east to west across the Site.

7.1.1 Soil Quality Summary

The following constituents, listed by frequency of occurrence, were observed above the NJDEP non-residential direct contact or impact to groundwater soil cleanup criteria in both surface and subsurface soils, on a site-wide basis: TPH, arsenic, and benzo(a)pyrene. Other constituents detected above criteria in surface and subsurface soils on a less frequent, and area-related, basis included the following: miscellaneous PAHs other than benzo(a)pyrene, VOCs (benzene, chlorobenzene, and xylenes), and some metals (lead, copper, beryllium, and zinc). Hexavalent chromium was also detected in areas where filling of chromate slag historically occurred, but was only detected above the criterion of 100 mg/kg in soils at three locations. Only one location in the entire Site exhibited a pesticide concentration above the criteria, and that was only in surface soil. PCBs were not detected in any soils at the Site.

7.1.2 NAPL Observations Summary

Seventeen NAPL plumes were identified during the RI and IRM activities. For discussion purposes, a NAPL plume was defined in Section 5.2.2 (Plant-Wide NAPL Overview) as an area in which the presence of NAPL was observed in either a temporary well point or monitoring well in at least two contiguous locations (see Figure 5-5). The seventeen NAPL plumes enumerated on Figure 5-5 include only NAPL observed floating on the water

table. A NAPL plume does exist in the intermediate water-bearing zone near the Platty Kill Canal; this deeper NAPL plume is depicted in cross-sectional view on Figure 4-5. This plume is the subject of a detailed IRM study (Dan Raviv Associates, Inc. 1994b) and IRM activities are ongoing. The plumes identified at the Site and enumerated on Figure 5-5 range in size from approximately 0.4 acre (Plume No. 3) to 7.6 acres (Plume No. 4) with apparent NAPL thicknesses ranging from 0.11 to 13.6 feet. Apparent thickness should not be confused with true "formation" NAPL thickness. Typically, in deposits with low hydraulic conductivities such as those observed at this site, true NAPL thicknesses are significantly less than apparent NAPL thicknesses. Product types have been differentiated based on specific gravity and on historical descriptions of tank contents, land use, or other anecdotal information. The following inferred product types were observed most frequently across the Site (see Table 5-10): diesel, No. 2 fuel oil, No. 6 fuel oil, kerosene, and lube oil.

7.1.3 Groundwater Quality Summary

The following constituents, listed by frequency of occurrence, were detected above the NJDEP standards or the IGGWQC on a site-wide basis: iron, manganese, and TPH. Other constituents observed above the standard less frequently, and on an area-specific basis, are as follows: VOCs (mostly benzene, chlorobenzene, ethylbenzene, and xylenes), SVOCs (generally limited to naphthalene and 2-methylnaphthalene), miscellaneous metals (aluminum, arsenic, lead, sodium, cadmium, chromium, nickel, beryllium, cobalt, and vanadium). Of the pesticides, alpha-BHC and 4,4'-DDT were observed in only one location each, and PCBs were not detected in any of the groundwater samples collected. Several wells exhibited chloride and sulfate above the standards, which is consistent with their near-shore location.

7.2 RELATIONSHIPS BETWEEN CONTAMINANTS AND FATE AND TRANSPORT ON AN AREA-SPECIFIC BASIS

This section addresses the relationship between soil quality, groundwater quality, and NAPL observations on an area-specific basis. TPH was the only constituent detected above

the soil and groundwater quality criteria on a site-wide basis. Concentrations of TPH were often detected significantly above the soil and groundwater quality criterion. These high TPH concentrations in soil and groundwater correlate well across the Site. The heavy PAHs [benzo(a)pyrene and other multi-ring compounds] that were observed often in soil were not observed above NJDEP groundwater quality standards at all in groundwater. With the exception of several locations, soil exceedances for metals were not significantly above the criteria. Most metal exceedances were no more than twice the cleanup criteria. Metals such as arsenic and lead were occasionally observed above the standards in groundwater, but to a lesser extent than they were observed in soil. VOCs found in soil were generally also found above standards in nearby groundwater but VOCs were more prevalent in groundwater than in soil. A discussion of area-specific contaminant fate and transport follows each area-specific discussion of contaminant relationships.

7.2.1 Piers and East Side Treatment Plant Area, and MDC Building Area

Contaminant relationships and contaminant fate and transport hypotheses are discussed below for the Piers and East Side Treatment Plant Area, and MDC Building Area.

7.2.1.1 Contaminant Relationships

As presented in Table 7-1, soil exceedances of TPH were identified in this area during the Phase IA RI. The exceedances observed for benzene, chlorobenzene, xylenes, and TPH in groundwater are probably a result of dissolution from the NAPL bodies identified in the area. This dissolution is evidenced by the results of TCL analysis on NAPL samples collected during the Pier 7 IRM. These analytical results indicated maximum concentrations in the NAPL of 22,000 ug/L for benzene, 21,000 ug/L for chlorobenzene, and 360,000 ug/L for o-xylene. Other target compounds, including ethylbenzene, methylene chloride, toluene, n-propyl benzene, acetone, SVOCs, and several chlorinated VOCs, that were identified in the NAPL are apparently not partitioning into groundwater.



The exceedances identified in the groundwater sample from the intermediate monitoring well (screened at 30 to 40 feet bls), including TPH, MEK (2-butanone), and pentachlorophenol (observed only in replicate sample), suggest that shallow groundwater may have leaked through the meadow mat/marsh clay confining unit in, or upgradient of, this area.

Water-level measurements indicate that there is a downward vertical gradient between the shallow and intermediate zones. MEK, a very soluble VOC, and pentachlorophenol, a relatively insoluble SVOC, were not detected in the NAPL samples from Pier 7.

The source of the TPH and benzene identified in the groundwater sample from Monitoring Well GMMW15, near the MDC Building, is probably not related to the Solvent Tank Field NAPL plume. These dissolved constituents may be from past spills from historical drum-filling activities and a naphtha filling building that operated in this area (Geraghty & Miller, Inc. 1994b).

Two shallow monitoring wells near the MDC Building Area (Monitoring Well EBR19 and Monitoring Well MW6, which is located to the east of the Low Sulfur Tank Field) and Intermediate Monitoring Well GMMW24I exhibit exceedances for a suite of metals dissolved in groundwater. These metals are antimony, beryllium, cadmium, chromium, cobalt, nickel, and vanadium. With the exception of chromium, none of these metals occurs in excess of NJDEP groundwater standards in any other monitoring wells at the Site. The presence of these dissolved metals may be related to the former Case & Can Plant, which operated in this area (Geraghty & Miller, Inc. 1994b).

7.2.1.2 Contaminant Fate and Transport

NAPL (Plumes No. 1 through 3) floating on the shallow water table and the dissolved constituents detected in shallow and intermediate monitoring wells have the potential to move toward, and eventually discharge into, New York Bay. Two parallel, concrete gantry walls, extending to a depth of 10 feet bls, are containing the NAPL in the vicinity of Pier 7. During extreme low tides, groundwater levels are sometimes lower than the two gantry walls, and



NAPL can then migrate beneath the walls into New York Bay (Dan Raviv Associates, Inc. 1995c). During high tide, the NAPL is trapped behind the walls. Exxon has installed a fixed boom containment system along the entire length of Pier 7. This containment system is effectively containing any NAPL seeps and preventing them from migrating out of the pier area further into the bay. Tidal studies conducted as part of the Pier 6 IRM indicated that groundwater flow in this area is toward the bay (eastward) during low tide and landward (westward) during high tide (Dan Raviv Associates, Inc. 1995b). This back-and-forth motion may result in static conditions for the floating NAPL identified in the two smaller plumes, resulting in no net flow into the bay.

The dissolved constituents are capable of undergoing biodegradation. Biodegradation is most likely enhanced in this area due to the influx and cycling of groundwater by the tides. Tidal flushing could result in constant replenishment of dissolved oxygen to the shallow groundwater, thereby enhancing aerobic degradation.

It is likely that the dissolved constituents are being biodegraded by aerobic processes in the tidally influenced groundwater zones adjacent to the piers; it is not currently known if the combination of biodegradation and the back-and-forth tidal motion completely removes dissolved constituents prior to discharge to the bay.

7.2.2 Low Sulfur and Solvent Tank Fields

The inter-media relationships and contaminant fate and transport hypotheses for the Low Sulfur and Solvent Tank Fields are discussed below.

7.2.2.1 Contaminant Relationships

There appears to be a strong correlation between NAPL and groundwater quality with respect to VOCs, but little correlation (with the possible exception of naphthalene) between soil and groundwater quality in this area. BTEX and two chlorinated VOCs were reported in

groundwater samples from monitoring wells in the Low Sulfur and Solvent Tank Fields. Concentrations of these constituents in groundwater were relatively high, as follows: benzene (73 to 710 ug/L), ethylbenzene (12,000 ug/L), and xylene (2,300 to 38,000 ug/L). These VOCs were identified as being primary constituents of the NAPL observed in the area (Dan Raviv Associates, Inc. 1993b). Thus, components of the NAPL appear to be partitioning into the groundwater and contributing to a dissolved phase plume. The chlorinated VOCs, 1,2-DCE (11,000 ug/L) and vinyl chloride (3,700 ug/L), were detected in one groundwater sample. The source of these constituents is not readily apparent. None of these chlorinated VOCs was reported in soil samples in concentrations that exceeded the soil cleanup criteria.

Naphthalene appears in groundwater at two locations at concentrations of 73 and 180 ug/L. 2-Methylnaphthalene and 2,4-dimethylphenol also exceeded the groundwater criteria at one location. Naphthalene was identified by DRAI (1993b) as being the most prevalent SVOC constituent of the NAPL present in the Low Sulfur and Solvent Tank Fields (Dan Raviv Associates, Inc. 1993b). Naphthalene exceeded the impact to groundwater soil cleanup criterion in a subsurface soil sample from one location in the Solvent Tank Field. Naphthalene in soil may be contributing to dissolved phase naphthalene, but is probably relatively insignificant compared to naphthalene partitioning from NAPL. Conversely, naphthalene associated with the NAPL (Plume No. 4) may be adsorbing to soils during rises in water levels and then dissolving into groundwater. 1,2-Methylnaphthalene and 2,4-dimethylphenol may also be present in the NAPL. Neither of these two constituents was reported in exceedance of the criteria in soil. Benzo(a)pyrene was reported in soil in exceedance of the non-residential soil cleanup criterion at one location in the Solvent Tank Field. The absence of benzo(a)pyrene in groundwater indicates that this compound is not partitioning to the dissolved phase.

There is little correlation between NAPL, soil quality, and groundwater quality with respect to metals. Of the metals reported in groundwater (antimony, arsenic, beryllium, cadmium, chromium, cobalt, and lead), only arsenic was detected in soil in exceedance of the non-residential soil cleanup criterion at one location. Lead, which was identified in NAPL, was detected in



exceedance of the NJDEP groundwater quality criteria in a groundwater sample from only one location.

7.2.2.2 Contaminant Fate and Transport

Most of the contaminants detected in soil [i.e., arsenic, copper, and benzo(a)pyrene] in the Low Sulfur and Solvent Tank Fields will tend to stay adsorbed in soil and will not partition to groundwater. Naphthalene may potentially partition from soil to groundwater, although this mechanism is probably not significant compared to partitioning from NAPL if it is present. Naphthalene was found in exceedance of the criteria in one soil sample and two groundwater samples in the area. The NAPL observed in the area (Plume No. 4) contains BTEX, naphthalene, a variety of PAHs, and lead. Based on the groundwater sampling results, the NAPL appears to be acting as a source of VOCs partitioning to groundwater. Soluble constituents (benzene, ethylbenzene, xylene, and naphthalene) were detected in groundwater in exceedance of the NJDEP groundwater quality criteria.

The dissolved constituents in groundwater are capable of undergoing biodegradation. Carbon dioxide and methane concentrations are elevated in Monitoring Wells MW6, MW9, and MW10, which indicates significant anaerobic biodegradation.

Although the regional groundwater flow is radial toward Upper New York Bay and the Kill Van Kull, migration of the floating NAPL plume in the vicinity of the Low Sulfur and Solvent Tank Fields appears to be limited. Based on the most probable source(s) of the NAPL in this area (i.e., historical spills in the tank fields prior to 1967 when gasoline was stored in the tank fields, and in 1979 when Tank 1066 released fuel oil), the floating NAPL plume does not appear to be migrating. Despite the relatively low density of the NAPL, the floating NAPL plume may be stabilized or contained within the apparent trough created in the shallow groundwater surface. The local trough may be the result of elevated hydraulic heads and tidal influence along areas of more permeable backfill along the northern and southern boundaries of the area.

The floating NAPL plume (Plume No. 4) is creating an associated dissolved phase plume. The extent of the dissolved phase constituents in the groundwater is not fully known. Dissolved NAPL constituents were detected in groundwater samples collected from the furthest downgradient monitoring wells along the southern boundary of the tank field. Based on the apparent local groundwater flow regime, the potential for off-site migration of dissolved phase constituents exists. There is evidence that anaerobic biodegradation processes are active in the vicinity of the Low Sulfur and Solvent Tank Fields, so the dissolved constituents are being degraded as they migrate, lowering their concentrations. Implementation of an IRM and other natural attenuation mechanisms (e.g., adsorption) will also help to limit the migration of constituents off-site.

7.2.3 General Tank Field

The inter-media relationships and the fate and transport hypotheses of contaminants in the General Tank Field are discussed below.

7.2.3.1 Contaminant Relationships

With the exception of naturally occurring constituents (e.g., sodium, chloride, iron, and manganese), groundwater exceedances are limited to TPH at four locations (ranging from 5 to 121 mg/L) and benzene at one location (2 ug/L). The presence of naturally occurring constituents at relatively high concentrations is probably related to the geochemistry of the fill and this area's history and proximity to the shoreline. Prior to development of Constable Hook, the General Tank Field area was submerged by the waters of Upper New York Bay.

With the exception of TPH detected in relatively high concentrations in soil and groundwater, there is no correlation between specific constituents detected in soil and groundwater or the occurrence of NAPL. The metals and benzo(a)pyrene detected in soil have not been detected in groundwater, and the NAPL is apparently not a source of soluble constituents that partition to groundwater.

7.2.3.2 Contaminant Fate and Transport

Most of the contaminants detected in soil in the General Tank Field [arsenic, lead, benzo(a)pyrene] will tend to stay adsorbed in soil and will not partition to groundwater. The exception is TPH. Extremely high levels of TPH in soil have leached to the groundwater below the General Tank Field. The two NAPL bodies (Plumes No. 5 and 6) in this area are not believed to be sources of contaminants to groundwater because the No. 6 fuel oil that appears to comprise these plumes does not contain appreciable soluble constituents for which there are groundwater standards. Only xylene in the subsurface soil exhibits the potential to leach to groundwater, but it is not observed in groundwater in excess of the applicable standard.

The lack of soluble organic constituents in groundwater beneath the General Tank Field may be related to natural degradation activities. The presence of elevated methane, carbon dioxide (CO₂), and sulfide in relatively high concentrations suggests that the decay of hydrocarbon constituents in the subsurface by anaerobic respiration of microorganisms is possible.

The NAPL bodies (Plumes No. 5 and 6) will potentially migrate to the north and east under the influence of groundwater flow, but migration will be significantly hindered by the high viscosity of the NAPL. The current NAPL plume bodies may be under equilibrium conditions, i.e., not migrating or growing appreciably over time.

7.2.4 AV-Gas Tank Field and Domestic Trade Area (Includes Southern Part of Interceptor Trench)

Contaminant relationships and fate and transport hypotheses for the AV-Gas Tank Field and Domestic Trade Area are discussed below.



7.2.4.1 Contaminant Relationships

With the exception of TPH, there is no correlation between observations of soil quality and groundwater quality in the AV-Gas Tank Field and the Domestic Trade Area. Groundwater quality beneath the AV-Gas Tank Field Area has not been evaluated due to the widespread presence of NAPL in monitoring wells and temporary well points installed in the area. The presence of NAPL and soil contamination in the AV-Gas Tank Field appear to be related.

7.2.4.2 Contaminant Fate and Transport

Most of the contaminants detected in soil in this area [i.e., arsenic and benzo(a)pyrene] will tend to stay adsorbed in soil and will not leach to groundwater. TPH was the only constituent observed in relatively high concentrations (i.e., above NJDEP criteria) in both soil and groundwater. The low carbon dioxide and methane concentrations in the one monitoring well sampled in the Domestic Trade Area suggest that little biodegradation is taking place, which may indicate that there is either limited organic contamination to act as a substrate for biological activity or oxygen levels may be insufficient to support aerobic bacteria.

The NAPL body (Plume No. 7) located along the plant perimeter in the AV-Gas Tank Field is migrating under the influence of groundwater flow. The western portion of this NAPL body is apparently captured by the interceptor trench. The eastern portion of this NAPL body should be investigated with regard to potential off-site migration. Although Figure 4-6 does not depict off-site migration of groundwater in this area, the potential for off-site migration does exist.

Dissolved constituents in groundwater may be migrating off-site; however, due to the presence of NAPL, dissolved constituents were not analyzed in the AV-Gas Tank Field. Dissolved organic constituents (other than TPH) were observed in one monitoring well in the Domestic Trade Area.



7.2.5 Asphalt Plant and Chemicals Plant (Includes Utility Area)

Contaminant relationships and fate and transport hypotheses are discussed below for the Asphalt Plant and Chemicals Plant Area.

7.2.5.1 Contaminant Relationships

Chlorobenzene appears in groundwater at a relatively high concentration (7,100 ug/L); it is possible that this chlorobenzene is related to the chlorobenzene detected in soil, particularly the high concentration (980,000 ug/kg) detected in the northern portion of the Chemicals Plant. It does not appear that chlorobenzene found in groundwater is related to NAPL, since the higher concentrations detected are not located downgradient of the NAPL plumes in this area (Plumes No. 8 and 9). A sewer investigation report by Sandaq, Inc. (1986) cited that chlorobenzene used at the Chemicals Plant was in the sewer system. However, although unrelated to this area, NAPL samples collected from monitoring wells at the interceptor trench area and Pier 7 IRM areas did show chlorobenzene present at concentrations up to 21,000 ug/L. The chlorobenzene was used solely at the Chemicals Plant and probably migrated to the pier area by way of the sewer system. Benzene detected in groundwater above the standard at one location did not have any related soil exceedances in this area. Chlorobenzene, 1,4-dichlorobenzene, and naphthalene were detected in soil above the impact to groundwater criteria and are also present in groundwater above New Jersey standards. The widespread benzo(a)pyrene exceedances in soil are apparently bound in the soil and, due to the chemical properties of benzo(a)pyrene (i.e., its high organic carbon partition coefficient), it is not expected to partition to groundwater. No monitoring wells are located immediately downgradient of the soil sample in the Chemicals Plant that showed high concentrations of xylenes, dichlorobenzene, and naphthalene, but a nearby monitoring well located in a side-gradient direction did show exceedances for 1,4-dichlorobenzene and naphthalene.

7.2.5.2 Contaminant Fate and Transport

Most of the contaminants detected in soil in this area [i.e., benzo(a)pyrene, arsenic] will tend to preferentially stay adsorbed to soil rather than partition to groundwater. Constituents that may be potentially leaching from soil to groundwater include chlorobenzene, 1,4-dichlorobenzene, and naphthalene. The chlorobenzene detected in subsurface soil, and to a lesser extent some of the other constituents detected in the Chemicals Plant, have the potential to leach to groundwater. The two NAPL plumes (Plumes No. 8 and 9) have specific gravities of lube oil, No. 6 fuel oil, or asphalt, which do not have appreciable soluble constituents for which there are groundwater standards.

The dissolved constituents are capable of undergoing biodegradation. This is supported by the high methane and carbon dioxide concentrations in nearby Monitoring Well GMMW3, suggesting that anaerobic biodegradation is occurring in the interior of this area.

The NAPL bodies (Plumes No. 8 and 9) are migrating under the influence of groundwater flow. The apparent No. 6 fuel oil or asphalt plume under the interior portion of the Chemicals Plant (Plume No. 8) has the potential to migrate to the east and southeast, but given the low permeability of the fill and high viscosity of the NAPL, it is migrating very slowly, if at all. The lube oil plume located south of the Chemicals Plant (Plume No. 9) also has the potential to migrate to the southeast, and there is a potential that it may migrate from the Utilities Area onto a small corner of off-site property. Similar to Plume No. 8, this NAPL body is moving very slowly, if at all.

7.2.6 No. 3 Tank Field

Contaminant relationships and fate and transport hypotheses for the No. 3 Tank Field are discussed below.

7.2.6.1 Contaminant Relationships

Chlorobenzene appears in groundwater at relatively high concentrations (270 to 14,000 ug/L); it is possible that this chlorobenzene is related to high concentrations detected in soil (35,000 to 110,000 ug/kg). The benzene detected at concentrations ranging from 5 to 170 ug/L in groundwater may have leached from soil, due to the benzene exceedances found in soil (11,000 ug/kg maximum). Some of the benzene detected may be present as a result of dissolution from NAPL bodies, but otherwise NAPL does not appear to be loading high concentrations of dissolved constituents to groundwater. Chromium observed above the 100-mg/kg criterion for soil was also detected in groundwater in excess of the groundwater quality standard. Arsenic was also observed in soil and groundwater in excess of the respective criteria.

7.2.6.2 Contaminant Fate and Transport

The NAPL plume (Plume No. 10) may be a source of VOCs to partition to groundwater, since it has a specific gravity similar to kerosene. The kerosene-like product has the potential to migrate to the south and southeast; a portion of this NAPL body may have already migrated off-site, as discussed in the IRM report (Geraghty & Miller, Inc. 1995a).

Dissolved constituents in groundwater are being transported with groundwater flow to the south and southeast. There is evidence of anaerobic biodegradation, so it is likely that the chlorobenzene and benzene concentrations are being reduced as they migrate in groundwater. The potential for off-site transport of chlorobenzene exists along the southern and southeastern edge of the No. 3 Tank Field, where dissolved chromium may also be transported off-site.

7.2.7 No. 2 Tank Field and Main Building Area (Includes Northern Part of Interceptor Trench)

The inter-media relationships and contaminant fate and transport hypotheses for the No. 2 Tank Field and Main Building Area are discussed below.



7.2.7.1 Contaminant Relationships

Benzene, xylenes, 2-methylnaphthalene, and naphthalene were reported in one groundwater sample from the No. 2 Tank Field, upgradient of the interceptor trench. Xylenes exceeded the impact to groundwater criterion in a subsurface soil sample collected from the eastern portion of the No. 2 Tank Field. It is possible that the xylenes present in subsurface soil, at least at this location, may be leaching to groundwater. Analytical results of NAPL samples collected from the Avenue J Sump and Sump A of the interceptor trench indicate that the primary constituents of the NAPL in this area (Plumes No. 11 and 12) are chlorobenzene, ethylbenzene, toluene, xylene, n-propylbenzene, and a suite of PAHs (Dan Raviv Associates, Inc. 1995a). It does not appear that the benzene, 2-methylnaphthalene, and naphthalene reported in the groundwater are related to the NAPL collected by the interceptor trench, since the monitoring well from which this sample was analyzed (Monitoring Well GMMW2) is located a significant distance upgradient of the interceptor trench and the NAPL plumes. These dissolved phase constituents may be remnants of a source further upgradient of the area. Lead exceeds the non-residential soil cleanup criterion in subsurface soil at two locations in this area. Lead does not appear in groundwater. Copper, total chromium, and hexavalent chromium, which were detected in subsurface soil samples in this area in exceedance of the criteria or comparative values, were not detected in groundwater. These observations support the interpretation that these metals do not appear to be leaching from soil to groundwater in this area. Arsenic was reported in excess of the non-residential soil cleanup criterion in one soil sample from the eastern Main Building Area. Dissolved arsenic was also reported in one groundwater sample collected from a well upgradient of this area. However, it is difficult to make an assessment based on these two data points as to whether arsenic is leaching from the soil.

Dissolution of constituents from the two NAPL bodies in the area may be occurring locally in the vicinity of the interceptor trench. Groundwater samples were not collected from immediately adjacent wells because of the presence of floating NAPL.



7.2.7.2 Contaminant Fate and Transport

Most of the contaminants detected in soil in this area (i.e., arsenic, chromium, copper, lead, and thallium) will tend to stay adsorbed in soil and will not leach to groundwater. Xylenes are the most likely constituent to potentially leach from soil to groundwater. The two NAPL bodies (Plumes No. 11 and 12) located along the northeastern boundary of this area appear to be capable of contributing dissolved phase constituents (e.g., benzene, chlorobenzene, xylene) to groundwater at the boundary. This phenomenon cannot be confirmed using the available groundwater data in these areas since flow is collected by the Interceptor Trench and further downgradient areas are off-site. Indicator parameter results for one groundwater sample from this area suggest that conditions appear to be suitable for biodegradation.

The two NAPL plumes (Plumes No. 11 and 12) are migrating under the influence of the prevailing groundwater flow direction to the northeast. As discussed in the Interceptor Trench NAPL IRM report, pumping of the trench only affects those wells nearest to the trench and does not alter regional groundwater flow. The results of the performance evaluation of the interceptor trench indicated that the section of the trench in this area is effective in capturing these NAPL bodies (Dan Raviv Associates, Inc. 1995a).

Dissolved constituents (e.g., benzene and xylene) in the groundwater are being transported with groundwater flow to the northeast. Dissolved phase contaminants will ultimately be captured by the interceptor trench. Although insufficient data exist to evaluate if active bioattenuation of dissolved phase constituents is occurring in this area, conditions appear to be suitable for biodegradation.

7.2.8 "A"-Hill Tank Field

The inter-media relationships and fate and transport hypotheses for contaminants detected in the "A"-Hill Tank Field are discussed below.



7.2.8.1 Contaminant Relationships

Arsenic and TPH exceed the NJDEP soil cleanup criteria in surface and subsurface soil samples analyzed. The arsenic was not detected in groundwater in excess of the groundwater quality standards, indicating that it does not appear to be leaching into the groundwater. TPH does appear to be leaching to the groundwater.

Based on the specific gravity (0.82) of the floating NAPL in this area, the NAPL is similar to diesel. Exclusive of iron and manganese, which appear to be regionally elevated in groundwater, benzene, xylenes, 2-methylnaphthalene, naphthalene, and dissolved lead (estimated 17.8 ug/L) were the constituent exceedances in groundwater. Although these constituents were observed upgradient of NAPL Plume No. 13, it is possible that the floating NAPL contributed dissolved phase benzene to the groundwater.

The PAHs [benzo(a)anthracene, benzo(a)pyrene, and benzo(a,h)anthracene] detected in subsurface soil indicates that the NAPL is adsorbing to the soil in the vadose zone and capillary fringe.

7.2.8.2 Contaminant Fate and Transport

The arsenic detected in soil in this area will tend to stay sorbed in soil and will not leach to groundwater.

The floating NAPL plume (Plume No. 13) appears to be acting as a source of dissolved phase benzene to partition to groundwater, since it has a specific gravity similar to diesel fuel and benzene also appears in groundwater downgradient of the NAPL plume. Dissolved VOCs and SVOCs are capable of undergoing biodegradation under either aerobic or anaerobic processes, assuming that suitable conditions prevail. One groundwater sample was collected from an upgradient monitoring well in the "A"-Hill Tank Field. Although it is not possible to demonstrate



that biodegradation is occurring in this area based on the results of one well, values of DO (7 mg/L) and pH (6.15) are consistent with a potential for aerobic degradation.

If the local groundwater divide interpreted in this area exists as shown on Figure 4-6, part of the floating NAPL plume (Plume No. 13) has the potential to spread and migrate to the east and northeast toward the Main Building Area. This portion of Plume No. 13 would ultimately be captured under the hydraulic influence of the interceptor trench, thereby preventing it from migrating off-site. In addition, a component of the NAPL plume located west of the interpreted groundwater divide has the potential to flow to the southwest. This will be further investigated during Phase IB. Given the low permeability of the fill and viscosity of the NAPL, the plume is migrating very slowly, if at all.

7.2.9 Lube Oil and Stockpile Area (Includes Platty Kill Canal)

The inter-media relationships and fate and transport hypotheses for contaminants detected in the Lube Oil and Stockpile Area are discussed below.

7.2.9.1 Contaminant Relationships

There is very little relationship between the compounds detected in soil in the Lube Oil/Stockpile Area and the compounds detected in groundwater. No VOCs were detected in soil at concentrations above the impact to groundwater criteria, although there were a few low exceedances of the groundwater standard for benzene in shallow monitoring wells. There were numerous exceedances for PAHs and metals in both shallow and subsurface soil samples. Two SVOCs [benzo(b)fluoranthene and pyrene] were detected in soil at concentrations above the impact to groundwater criteria, but these compounds were not identified at elevated concentrations in groundwater samples. The only metal detected in soil that may be partitioning into groundwater is arsenic, which was detected in one groundwater sample at a concentration an order of magnitude above the groundwater quality standard.

The lack of VOCs in soil samples and the presence of VOCs in groundwater indicates that the source of the VOCs in groundwater is probably related to historical spills or NAPL plumes that have been recently identified. The source of the VOCs is probably not related to ongoing leaching from soils.

7.2.9.2 Contaminant Fate and Transport

NAPL floating on the shallow water table and NAPL identified in the confined intermediate zone has the potential to move toward and eventually discharge to the Platty Kill Canal. Dissolved constituents that are most likely associated with these NAPL bodies also have the potential to eventually discharge to the Platty Kill Canal. However, none of the shallow wells located directly adjacent to the canal contains floating NAPL. IRM studies conducted in the Platty Kill Canal Area found that the tidal influence on the shallow water table is limited to wells located directly adjacent to the canal; these gradient and flow reversals were observed (Dan Raviv Associates, Inc. 1994b). However, although the potential exists, no migration of NAPL in the shallow groundwater zone to Platty Kill Canal has been observed.

A laterally continuous and relatively thick clay and silt layer exists beneath the Platty Kill IRM Area. This layer separates the unconfined and confined zones and provides a confining layer to the deep zone (Dan Raviv Associates, Inc. 1994b). The lateral continuity of the clay and silt layer was confirmed by tidal and pumping test water-level measurements that suggested a lack of hydraulic connection between the two zones. Tidal influence was observed in all of the deeper intermediate zone monitoring wells. A dampened tidal amplitude and a succession of longer delay times was observed in these wells as distance from the canal increased. These tidal effects provide a tidal barrier between the confined zone and the Platty Kill Canal, effectively preventing the discharge of NAPL from this deeper zone to the canal.

Very little DO was detected in both the shallow (0.7 mg/L) and intermediate groundwaters (1.0 mg/L). Both of these zones contained little to no methane and moderate



concentrations of carbon dioxide, suggesting that little biodegradation is taking place due to lack of significant substrate or not enough oxygen to support aerobic biological activity.

The absence of floating NAPL in monitoring wells located downgradient and adjacent to the Platty Kill Canal indicates that the floating NAPL in all of the identified plumes is well defined and is not posing an imminent threat to the nearby surface-water bodies. Both the NAPL and dissolved constituents have the potential to flow toward the Platty Kill Canal, but IRM studies indicate that tidal effects are effectively preventing discharge into the canal.

7.2.10 Pier No. 1 Area (Includes Helipad)

The contaminant relationships and fate and transport hypotheses for the Pier No. 1 Area are discussed below.

7.2.10.1 Contaminant Relationships

One soil sample from the Pier No. 1 Area contained exceedances for several PAHs and arsenic. Low concentrations of PAHs (below the groundwater quality standard) were identified in the shallow groundwater sample from existing Monitoring Well EB1, indicating that these compounds are not partitioning in significant quantities to shallow groundwater. Several chlorinated compounds, including TCE, PCE, 1,2-DCE, and vinyl chloride, were identified at elevated concentrations in the groundwater sample from intermediate Monitoring Well GMMW21I. These compounds were not detected in soil samples collected in this area, nor were they detected in the TCL analysis of NAPL collected from the shallow water-bearing zone (Dan Raviv Associates, Inc. 1995d). The source of the chlorinated compounds is unknown. The pesticide, alpha-BHC, which was also detected in the intermediate groundwater sample may have been mobilized by the presence of the other dissolved chlorinated compounds.



7.2.10.2 Contaminant Fate and Transport

NAPL (Plume No. 17) floating on the shallow water table and the dissolved constituents detected in shallow and intermediate monitoring wells have the potential to move toward, and eventually discharge into, the Kill Van Kull Waterway. Bulkheading installed to depths of 40 to 60 feet in the area of the old Pier No. 1 appears to channel groundwater movement toward the deteriorated portion of steel sheet pile bulkhead near the Salt Water Pumping Station.

The dissolved constituents are amenable to biodegradation. Biodegradation is most likely enhanced in this area due to the influx and cycling of groundwater by the tides. Tidal flushing could result in a constant supply of dissolved oxygen to the dissolved-phase portion of the plume, thereby enhancing aerobic degradation.

Both floating NAPL and dissolved constituents in groundwater have the potential to migrate and eventually discharge to the Kill Van Kull Waterway. NAPL (Plume No. 17) migration is significantly hindered by the tidal reversal of groundwater flow and also by the bulkheading that has been installed along the local western, central, and eastern shores. The IRM studies indicate that the eastern bulkheading is in poor, deteriorating condition, and NAPL and groundwater do have the potential to migrate and possibly discharge to the Kill Van Kull Waterway in this direction. The western and southern shore bulkheads are deeper, extend to clay layers, are constructed with concrete, and are in better condition, forming an effective barrier to migration.

The chlorinated VOCs detected in Intermediate Monitoring Well GMMW21I have the potential to be transported to the Kill Van Kull Waterway. However, the migration will be retarded by attenuation and by tidally influenced reversals in gradient. Any chlorinated VOCs that ultimately discharge to the Kill Van Kull Waterway will be immediately diluted to concentrations below detection limits due to the enormous flow in this surface-water body and the extremely low groundwater discharge rates from the intermediate water-bearing stratum.



7.3 POTENTIAL REMEDIAL REQUIREMENTS FOR NAPL

This section describes the goals of remediation specific to the NAPL plumes delineated at the site. NAPL plumes that warrant mitigation in accordance with the established goals are identified, followed by a list of potential remedial technologies that could satisfy the remedial objectives.

7.3.1 Remedial Goals for NAPL

NAPL remedial decisions for the Bayonne Plant will be guided by the following remedial goals:

- Intercept off-site migration and reduce potential off-site exposure.
- Reduce potential on-site exposure to workers either by direct contact or other concerns (e.g., explosion or vapor generation).
- Eliminate sources of dissolved groundwater contamination if it is a threat to significant resources.
- Mitigate significant volumes of NAPL where recoverable by practical means before it becomes more difficult to recover.



7.3.2 NAPL Areas That Warrant Remediation

Listed below are the areas of the Bayonne Plant with NAPL plumes that warrant remediation in accordance with the goals described above. These plumes are enumerated consistent with Figure 5-5 and Tables 5-10 and 7-1.

<u>Area</u>	<u>Plume No.</u>	<u>Remedial Goal(s) To Be Addressed</u>
Piers and East Side Treatment Plant	1, 2, 3	Off-site migration.
Low Sulfur and Solvent Tank Fields	4	On-site exposure. Significant volume. Probable dissolved migration.
AV-Gas Tank Field	7	Off-site migration.
Utilities Area	9	Off-site migration.
No. 3 Tank Field	10	Off-site migration. On-site exposure.
"A"-Hill Tank Field	13	Significant volume. Probable dissolved migration.
Stockpile/Platty Kill Area	15, 16	Eventual off-site migration.
Pier No. 1 Area (Helipad)	17	Off-site migration.

Each of the areas listed above except Plume No. 15 has been investigated during IRM studies and will remain a focus of remedial efforts. Plumes 5, 6, 8, and 14 appear to be stable on-site at present. Plumes 11 and 12 seem to be controlled by the Interceptor Trench. These will be further characterized during subsequent phases of the RI.



7.3.3 Potential Remedial Technologies for NAPL

The following remedial technologies will be considered for NAPL mitigation at the Bayonne Plant:

- Conventional recovery/containment in wells by either pumping of total fluids (single pump), dual phase pumping (two pumps), or passive skimming.
- Vacuum-enhanced recovery by low vacuum (generally less than 5 psi), with a skimmer pump for NAPL recovery only.
- Vacuum-enhanced recovery by high vacuum (generally greater than 10 psi), for NAPL and water recovery.
- Horizontal wells.
- Interceptor trenches with either passive skimming or pumping.
- Impermeable barriers to funnel NAPL migration to a collection well or trench.
- Natural attenuation.

7.4 DATA GAPS FOR NAPL REMEDIATION

Some or all of the following data gaps will need to be addressed for each NAPL body listed in Section 7.3.2 (NAPL Areas That Warrant Remediation) to design optimal remedial systems for NAPL mitigation:



- The actual extent of the NAPL body in the vertical plane (i.e., apparent versus true NAPL thickness) by performing bail-down tests in existing wells.
- The horizontal extent of some of the NAPL bodies, particularly the southernmost NAPL plume in the No. 3 Tank Field (Plume No. 10 on Figure 5-5), as noted in the NAPL IRM report (Geraghty & Miller, Inc. 1995a).
- The mobile or static nature of some of the NAPL bodies and the direction of migration, through continued monitoring of existing wells and additional wells installed during subsequent phases of the RI.
- Hydraulic characteristics of the saturated subsurface materials through pumping tests, slug tests, and physical testing (e.g., grain size distribution).
- Physical and chemical characteristics of the NAPL, through laboratory analysis.

These data gaps will be addressed in formulating work plans for subsequent phases of the RI.



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Table 3-1. Number of Analyses Conducted for Phase IA Soil and Groundwater Samples, Bayonne Plant, Bayonne, New Jersey.

Matrix	TPH	TCL VOCs ³	TCL SVOCs	TCL Pesticides/PCBs	TAL ^{1,2,7} Metals	Total ² Chromium	Hexavalent ² Chromium	Wet Chemistry ⁴	Dissolved Gases ⁵
<u>Soil</u>									
Phase IA RI Soil Borings (84 locations)	155	91	92	88	88	153	125	NA	NA
IRM Soil Borings (14 locations)	28	17	16	17	24	28	16	NA	NA
<u>Groundwater</u>									
Phase IA RI Wells	21	21	21	21	216 ⁴	21 ⁴	21 ⁷	17	17
Phase IA RI Drivepoints		13							
Existing Wells		10	10	10	106 ¹	10 ¹	10	10	10

QA/QC samples (i.e., replicates, matrix spike/matrix spike duplicates [MS/MSDs], field blanks, and trip blanks) are not included.

QA/QC Quality assurance/quality control.

TPH Total petroleum hydrocarbons.

TCL Target compound list.

VOCs Volatile organic compounds.

SVOCs Semivolatile organic compounds.

PCBs Polychlorinated biphenyls.

TAL Target analyte list.

NA Not analyzed.

¹ Does not include chromium analysis, which are tabulated separately.

² Unless otherwise indicated, groundwater samples were analyzed for dissolved constituents. A subset of the number of dissolved samples were also analyzed for total constituents, as indicated in parentheses and italics.

³ Include miscellaneous alcohols and site-specific compounds.

⁴ Wet chemistry parameters consist of chloride, alkalinity, sulfate, sulfide, total dissolved solids, biological oxygen demand, chemical oxygen demand, nitrate, phosphate, total organic carbon, ammonia, total iron, and total manganese.

⁵ Dissolved gases consist of carbon monoxide, carbon dioxide, dissolved oxygen, methane, and nitrogen dioxide.

⁶ A total of 28 groundwater samples was analyzed for total and dissolved iron and manganese.

⁷ One sample was also analyzed as a total due to the high turbidity.



Table 3-2. Summary of Operational Area Prefix Codes, Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Zone	Operational Area	Prefix Codes	Prefix Code Exceptions*
AHTF	"A"-Hill Tank Field	AHTF	
LO	Lube Oil Area	LO, LA	
P1	Pier No. 1 Area	PN1	LA (1)
N2TF	No. 2 Tank Field	N2TF	
AP	Asphalt Plant	AP	N3TF (1)
AGTF	AV-Gas Tank Field	AGTF	
ECP	Exxon Chemical Plant	ECP	EC2 (1)
N3TF	No. 3 Tank Field	N3TF	EC (1)
GTF	General Tank Field	GTF	EGTF (1)
STF	Solvent Tank Field	STF	GF (1)
PEST	Piers and East Side Treatment Plant	PEST	
DT	Domestic Trade Area	DT	
MB	Main Building Area	MB	PS (1)
MDC	MDC Building Area	MDC	
U	Utilities Area		EC (2), T998 (1)
SS	Stockpile Area	SS	LO (1)

* Prefix code exception with number of prefix code exceptions indicated in parentheses.



Table 3-3. Rationale for Selection of Soil Borings and Monitoring Wells for the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Page 1 of 6

Boring/Well Identification	Adjacent to Sewer	Adjacent to Sanitary Septic System	Documented Spill	Historical Process Area	Adjacent to Former Oil-Water Separator	Location Selected to Provide Broad Areal Coverage	Comments
<u>"A" - Hill Tank Area</u>							
AHTFSB1	X						Current and former storage tanks.
AHTFSB2	X						Current and former storage tanks.
AHTFSB3	X		X		X		Current and former storage tanks.
AHTFSB4	X		X				Current and former storage tanks.
<u>Lube Oil Area</u>							
LOSB1	X		X	X			Former MEK Plant, Phenol Plant, and truck loading area.
LOSB2	X			X			Former separator and agitator tanks. Nearby substation transformer area.
LOSB3				X		X	Former clay filter building, shops, and pump house.
LOSB4	X		X		X		Former storage tanks.
LOSB3/GMMW1						X	Former storage tanks. Nearby railroad loading area.
LOSB6		X					Former shops.
LOSB7		X					Former barrel factory and boiler house.
LOSB9	X		X				Former storage tanks. Nearby truck loading areas.
LOSB10	X	X	X				Former storage tanks. Nearby truck and railroad loading areas.
LOSB11		X					Former storage tanks and shops.
LOSB12	X		X	X			Former MEK and Phenol Plants, pump house, truck loading and stills area.
LOSB13			X				Former storage tanks, separator, and pump house.
LOSB14	X						Former storage tanks and acid tanks.
LOSB15						X	Former railroad tracks and loading racks.
LOSB16			X				Former storage tank and truck loading area.
LOSB17		X		X	X		Former storage tanks and separator.
LOSB18				X	X		Former main separator for Lube Oil Area.
* LOSB19/GMMW22D	X					X	Stratigraphic boring; former supply house.
† LAIRMB1						X	Former truck loading rack; railroad car filling rack.
† LAIRMB2							
† LAIRMB3							East of former paint shop/machine shops.
† LAIRMB4/GMMW19							Former barrel factory and boiler house.
† LAIRMB5							Northeast of former experimental laboratory.
† LAIRMB6							Southeast of former experimental laboratory.

See last page for footnotes.

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Table 3-3. Rationale for Selection of Soil Borings and Monitoring Wells for the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

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Boring/Well Identification	Adjacent to Sewer	Adjacent to Sanitary Septic System	Documented Spill	Historical Process Area	Adjacent to Former Oil-Water Separator	Location Selected to Provide Broad Areal Coverage	Comments
<u>Fig No. 1 Area</u>							
GMMW21I						X	Intermediate monitoring well.
* PN18B1/GMMW21D						X	Stratigraphic boring and deep monitoring well.
‡ PN18B2						X	Former pump house and transformer area.
† LAJRM67							East of old saltwater pump house in transformer area.
<u>No. 2 Tank Field</u>							
N2TFSB1/GMMW2			X	X			Former boiler house and sweetening stills.
N2TFSB2	X			X			Former storage tanks, boiler house, and sweetening stills.
N2TFSB3							Former storage tanks, pipe shop, and pump house.
N2TFSB4	X						Former storage tanks.
N2TFSB5				X	X		Pump house, separator, stacks, and furnaces.
N2TFSB6	X						Former pump house and storage tanks.
<u>Asphalt Plant Area</u>							
APSB1	X						Former pitch drum filling and storage shed, adjacent to former tanks and agitators.
APSB2/GMMW3	X	X					Former pitch drum shed, pump house and piping manifolds. Transformer area.
APSB3	X		X				Former storage tanks. Active truck loading area.
APSB4						X	Former storage tanks and pump house.
APSB5/GMMW4	X					X	Former pump house and storage tanks.
APSB6				X	X	X	Former off-gas incinerator, oxidizer, ferric chloride tank; near a transformer area.
GMMW23I	X	X					Intermediate depth well.
* APSB7/GMMW23D	X	X				X	Stratigraphic boring and deep well. Railroad car filling area, former drum filling area and storage area.
N3TFSB2		X					current and former storage tanks.
<u>AV-Qas Tank Field</u>							
AGTFSB1	X			X	X		Former storage tanks and crude stills; near transformer area.
AGTFSB2	X		X	X			Former crude stills.
AGTFSB3	X		X	X			Former storage tanks and colprobian asphalt pans.
AGTFSB4	X						Near former pitch filling plant and asphalt pans.

See last page for footnotes.

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Table 3-3. Rationale for Selection of Soil Borings and Monitoring Wells for the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Page 3 of 6

Boring/Well Identification	Adjacent to Sewer	Adjacent to Sanitary Septic System	Documented Spill	Historical Process Area	Adjacent to Former Oil-Water Separator	Location Selected to Provide Broad Areal Coverage	Comments
<u>Exxon Chemicals Plant</u>							
ECPSB1	X						Transformer area.
ECPSB2	X	X	X				Former storage tanks and pipe trench near substation and truck loading area.
ECPSB3	X		X	X			Pipe still and chemical plant units.
ECPSB4	X	X	X	X			Condenser and pipe stills, separator, and pipe trench.
ECPSB5			X	X			Chlorine car and truck yard; former underground storage tanks, acid neutralization pit, perspold and paraflow plants.
<u>No. 3 Tank Field</u>							
N3TFSB1/GMMW3	X		X			X	Current and former storage tanks.
N3TFSB3/GMMW6						X	Current and former storage tanks.
N3TFSB4					X		Current and former storage tanks.
N3TFSB5	X						Current and former storage tanks.
N3TFSB6	X						Current and former storage tanks.
N3TFSB7	X		X				Current and former storage tanks.
N3TFSB8/GMMW7			X			X	Current and former storage tanks.
N3TFSB9						X	
† 3TFIRMB1/GMMW16							Former storage tanks south of pipe trench.
† 3TFIRMB2							Former storage tanks south of pipe trench.
† 3TFIRMB3/GMMW17							Former sloop tank near separator.
† 3TFIRMB4					X		Former separator, concrete separator outfall, and sloop well.
† ECIRMB3	X						Former tile acid sewer.
<u>General Tank Field</u>							
QTFSB1/GMMW8						X	Current and former storage tanks near former separator sludge area potentially containing lead.
QTFSB2	X						Current and former storage tanks.
QTFSB3/GMMW9						X	Current and former storage tanks.
QTFSB4	X						Current and former storage tanks within old municipal landfill area.
QTFSB5						X	Current and former storage tanks.
QTFSB6/GMMW10						X	Current and former storage tanks.
QTFSB7	X		X				Current and former storage tanks.
QTFSB8	X						Current and former storage tanks near pump house.

See last page for footnotes.

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Table 3-3. Rationale for Selection of Soil Borings and Monitoring Wells for the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

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Boring/Well Identification	Adjacent to Sewer	Adjacent to Sanitary Septic Systems	Documented Spill	Historical Process Area	Adjacent to Former Oil-Water Separator	Location Selected to Provide Broad Areal Coverage	Comments
<u>General Tank Field</u> (continued)							
OTFSB9	X						Current and former storage tanks.
OTF8B1			X			X	Fill area east of current and former storage tanks.
† OTFIRMB1					X		Current and former storage tanks.
† OTFIRMB2						X	Current and former storage tanks.
† OTFIRMB3							Current and former storage tanks.
† OTFIRMB4							Current and former storage tanks.
† OTFIRMB5/GMMW20							Current and former storage tanks.
† OTFIRMB6							Current and former storage tanks.
† OTFIRMB7							Current and former storage tanks.
† OTFIRMB8							Current and former storage tanks.
† OTFIRMB9							Current and former storage tanks.
† OTFIRMB10							Current and former storage tanks.
† OTFIRMB11							Current and former storage tanks.
† OTFIRMB12							Current and former storage tanks.
† OTFIRMB13			X				Current and former storage tanks.
† OTFIRMB14			X				Current and former storage tanks.
† OTFIRMB15			X				Current and former storage tanks.
† OTFIRMB16			X				Current and former storage tanks.
† OTFIRMB17	X		X				Current and former storage tanks.
† OTFIRMB18	X		X				Current and former storage tanks.
<u>Solvent Tank Field</u>							
STFSB1	X		X	X		X	Former pump house, truck loading area, manifold pits, and transformer area near former Lower Hook Nap and Acid Tank Field, and drum filling building. Former truck loading area.
STFSB2	X	X	X				Former storage tanks and pump pad with nearby truck and rail loading areas and transformers.
STFSB3	X	X					Former storage tanks.
GFSB1/GMMW14	X					X	Former truck rack and Norton spheroid.

See last page for footnotes.



Table 3-3. Rationale for Selection of Soil Borings and Monitoring Wells for the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

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Boring/Well Identification	Adjacent to Sewer	Adjacent to Sanitary Septic System	Documented Spill	Historical Process Area	Adjacent to Former Oil-Water Separator	Location Selected to Provide Broad Areal Coverage	Comments
<u>Piers and East Side Treatment Plant Area</u>							
PESTSBI	X	X	X		X		Current and former large separator. Near former pump house and truck loading area.
PESTSBI	X				X		Barrel filling building. Near truck loading area.
GMMW24I		X				X	Intermediate depth well.
* PESTSB3/GMMW24D						X	Stratigraphic boring and deep monitoring well barrel staging area near transformers and truck loading area.
<u>Domestic Trade Area</u>							
DTSBI/GMMW11				X			Former cracking coil area near truck loading area, former underground storage tanks, and pump house.
DTSBI				X			Former cracking coil area near truck loading area, former underground storage tanks, and pump house.
DTSBI						X	
<u>MISCELLANEOUS AREAS</u>							
<u>Utilities Area</u>							
† ECIRMB1				X			Former boiler house and former sludge tank, near transformers.
† ECIRMB2/GMMW18						X	
EC2SB1		X					Former transformer area.
** T99SB1/GMMW13	X					X	Former boiler house.
<u>Main Building Area</u>							
MBSBI	X						Former storage tanks near transformers.
MBSBI	X						Former storage tanks near underground storage tanks.
MBSBI					X		Former storage tanks, sweetening stills, and underground storage tanks.
MBSBI				X			Former storage tanks, stirring tanks, and compound building, near transformers.
PSSBI		X		X			Former reducing stills, paraffin boiler house, and pump house.

See last page for footnotes.



Table 3-3. Rationale for Selection of Soil Borings and Monitoring Wells for the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

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Boring/Well Identification	Adjacent to Sewer	Adjacent to Sanitary Septic System	Documented Spill	Historical Process Area	Adjacent to Former Oil-Water Separator	Location Selected to Provide Broad Areal Coverage	Comments
MDC Building Area							
MDCSB1	X	X		X			Former Butterworth System, Inc. building, light oil filling building, and fuel station. Near former drum filling building and underground storage tanks.
MDCSB2/GMMW13				X		X	Former Naptha filling building.
Stockpile Area							
SSB1				X			Former MEK Dewaxing Plant and Phenol Plant area near former transformers.
SSB2/GMMW12				X			Former MEK Dewaxing Plant and Phenol Plant area near former transformers.
SSB3				X	X		Former MEK Dewaxing Plant and Phenol Plant area. Former storage tanks and wax area.
LOSB8				X	X		Former MEK Dewaxing Plant and Phenol Plant area, and stills area.

CMERP Construction Measures Emergency Repairs Protocol.

IRM Interim Remedial Measure.

NAPL Non-aqueous phase liquid.

* Denotes a stratigraphic soil boring that was converted into a deep monitoring well.

† Denotes an IRM soil boring/monitoring well.

** Soil Borings N3TFSB9 and PN1SB2 added to the RI field program: PN1SB2 was a CMERP soil boring added at the request of Exxon; N3TFSB9 was added to delineate NAPL in the No. 3 Tank Field.

Note: Soil borings and monitoring wells are listed above under the operational area in which the soil boring /monitoring well is located and not necessarily under the operational area that they were intended to evaluate (i.e., certain IRM soil borings in the Pier No. 1 Area and in the Utilities Area were intended to address potential NAPL migrating from the Lube Oil Area and Chemical Plant Area, respectively).



Table 3-4. Location and Rationale for Relocation of Phase IA Soil Borings and Monitoring Wells, Bayonne Plant, Bayonne, New Jersey.

Location I.D.	Distance and Direction Moved from Formerly Proposed and Approved Location	Rationale for Moving the Location	Final Location Description
<u>"A" Hill Tank Field</u>			
AHTFSB4	60 ft SE	Surface water inside fire bank prevented access.	North of tank 516.
<u>Lube Oil Area</u>			
LOSB1	220 ft SE	Moved at request of John Boyer of the NJDEP to area near spill culvert at Tank 411.	Northeast of tank 411.
LOSB10	80 ft N	Moved due to subsurface concrete.	West of Control House at Lube Oil Area.
LOSB15	60 ft W	Moved into open area to complement spacing between RI and IRM borings.	East of tank 57.
LOSB16	40 ft WSW	Moved downgradient of documented spill or release.	Southwest of tank 46.
<u>Pier No. 1 Area</u>			
PN1SB1	60 ft NW	Moved north due to bulkheading along pier.	East southeast of the Helipad Pier No. 1
<u>No. 2 Tank Field</u>			
N2TFSB6	100 ft ESE	Moved to former process area.	East of tank 1001.
<u>Asphalt Plant Area</u>			
N3TFSB2	40 ft N	Moved to previous truck loading rack on other side of fence. Location was inaccessible due to pipe racks and utilities.	East of truck loading rack.
<u>Exxon Chemical Plant Area</u>			
EC2SB1	100 ft E	Moved as close as possible to sanitary sewer due to low overhead utilities at original location.	East of the Exxon Chemical Building No. 2.
ECPSB5	100 ft WSW	Moved downgradient (to a gravel area) along railroad loading area due to poor access and train traffic at original location.	Northwest of tank 916.



Table 3-4. Location and Rationale for Relocation of Phase IA Soil Borings and Monitoring Wells, Bayonne Plant, Bayonne, New Jersey.

Location I.D.	Distance and Direction Moved from Formerly Proposed and Approved Location	Rationale for Moving the Location	Final Location Description
<u>No. 3 Tank Field</u>			
GMMW7	80 ft NE	Moved towards area containing visually stained soil.	West of GMMW16.
<u>General Tank Field</u>			
GTFIRMB8	140 ft WSW	Moved into the interior of the tank field to complement spacing of IRM and RI borings.	Inside the firebank north of tank 1073.
GTFBIRMB18	60 ft E	Moved to road edge due to overhead utilities.	Northwest of electrical Substation No. 3.
EGTFSB1	100 ft S	Construction debris prevented access to original location.	North of Substation No. 3.
<u>Piers and East Side Treatment Plant Area</u>			
PESTSB1	40 ft W	Moved to edge of former oil/water separator.	East of Granular Activated Carbon Building.
PESTSB2	40 ft W	Moved to other side of fence due to pipe rack.	
PESTSB3	200 ft SW	Moved based on access problems due to bulkhead along pier, and also to complement well spacing.	East of Substation No. 4.
<u>Domestic Trade Area</u>			
DTSB3	40 ft W	Moved due to low overhead utility line.	
<u>Utilities Area</u>			
GMMW13	40 ft W	Moved to complement spacing with IRM borings.	West of tank 998.

See last page for footnotes.



Table 3-4. Location and Rationale for Relocation of Phase IA Soil Borings and Monitoring Wells, Bayonne Plant, Bayonne, New Jersey.

Location I.D.	Distance and Direction Moved from Formerly Proposed and Approved Location	Rationale for Moving the Location	Final Location Description
<u>Main Building Area</u>			
PSSB1	150 ft NW	Moved due to low overhead utilities and old buried railroad ties; also to delineate the extent of NAPL which was observed in the "A"-Hill Tank Field and Main Building areas.	North of the Paramins Store House.
MBSB1	40 ft N	Moved due to proximity to Main Building.	North of Main Building (middle of parking lot).
<u>Stockpile Area</u>			
GMMW12	185 ft NW	Moved to complement spacing with DRAI wells.	Stockpile Area.
SSB1	100 ft ESE	Moved due to access problem at original location.	West of tank 404.

ft	Feet.
SE	Southeast.
N	North.
W	West.
WSW	West southwest.
NW	Northwest.
ESE	East southeast.
E	East.
NE	Northeast.
S	South.
SW	Southwest.
NJDEP	New Jersey Department of Environmental Protection.
RI	Remedial Investigation.
IRM	Interim Remedial Measure.
NAPL	Non-aqueous phase liquid.
DRAI	Dan Raviv Associates, Inc.



Table 3-5. Phase IA Remedial Investigation Monitoring Well Construction Details, Bayonne Plant, Bayonne, New Jersey.

Well ID	Well Completion Date	Well Screen and Casing Diameter (inches)	Well Screen Material (20-slot wound)	Total Depth of Well (ft bls)	Depth of Screened Interval (ft bls)	Depth to Top of Sand Pack (ft bls)	Depth to Top of Bentonite Slurry (ft bls)	Measuring Point Elevation *		Depth to Top of Bedrock (ft bls)	Top of Bedrock Elevation (ft bls)
								Ground	Top of PVC		
<u>Shallow</u>											
GMMW1	10/11/94	4	PVC	12.5	2.5 - 12.5	1.5	0.5	10.3	9.70	NA	NA
GMMW2	10/12/94	4	PVC	16.0	6.0 - 16.0	4.0	2.0	17.6	17.44	NA	NA
GMMW3	10/26/94	4	PVC	17.0	7.0 - 17.0	5.0	3.0	15.9	15.17	NA	NA
GMMW4	10/12/94	4	PVC	14.0	4.0 - 14.0	2.0	1.0	10.3	9.72	NA	NA
GMMW5	10/18/94	4	PVC	13.0	3.0 - 13.0	2.0	1.0	9.7	9.26	NA	NA
GMMW6	10/13/94	4	PVC	14.0	4.0 - 14.0	3.0	2.0	12.4	14.43	NA	NA
GMMW7	10/18/94	4	PVC	13.0	3.0 - 13.0	2.0	1.0	9.1	8.36	NA	NA
GMMW8	10/10/94	4	PVC	16.0	3.0 - 16.0	2.0	1.0	9.4	8.80	NA	NA
GMMW9	10/10/94	4	PVC	13.0	3.0 - 13.0	2.0	1.5	8.6	7.91	NA	NA
GMMW10	10/11/94	4	PVC	13.0	3.0 - 13.0	2.0	1.0	9.3	8.88	NA	NA
GMMW11	10/27/94	4	PVC	15.5	5.5 - 15.5	3.5	2.0	11.8	11.58	NA	NA
GMMW12	10/12/94	4	PVC	13.0	3.0 - 13.0	2.0	1.0	10.5	13.73	NA	NA
GMMW13	10/12/94	4	PVC	13.0	3.0 - 13.0	2.0	1.0	9.8	11.85	NA	NA
GMMW14	10/12/94	4	PVC	14.0	4.0 - 14.0	3.0	1.0	9.6	9.30	NA	NA
GMMW15	10/11/94	4	PVC	16.0	6.0 - 16.0	4.0	2.0	9.6	9.45	NA	NA
GMMW16	10/17/94	4	PVC	12.5	2.5 - 12.5	1.5	0.5	8.9	11.61	NA	NA
GMMW17	11/1/94	4	PVC	12.5	2.5 - 12.5	1.5	0.5	8.8	10.91	NA	NA
GMMW18	11/2/94	4	PVC	14.0	4.0 - 14.0	3.0	0.5	12.2	15.09	NA	NA
GMMW19	11/2/94	4	PVC	12.0	2.0 - 12.0	1.0	0.5	8.3	11.12	NA	NA
GMMW20	11/1/94	4	PVC	14.0	4.0 - 14.0	2.0	1.0	8.9	8.22	NA	NA
<u>Intermediate</u>											
GMMW21I	11/17/94	4	PVC	40.0	30.0 - 40.0	26.0	24.0	10.5	13.2	NA	NA
GMMW23I	12/30/94	4	PVC	65.0	55.0 - 65.0	53.0	51.0	15.8	15.14	NA	NA
GMMW24I	11/30/94	4	PVC	40.0	30.0 - 40.0	26.0	24.0	9.4	8.93	NA	NA

See last page for footnotes.



Table 3-5. Phase IA Remedial Investigation Monitoring Well Construction Details, Bayonne Plant, Bayonne, New Jersey.

Well ID	Well Completion Date	Well Screen and Casing Diameter (inches)	Well Screen Material (20-slot wound)	Total Depth of Well (ft bls)	Depth of Screened Interval (ft bls)	Depth to Top of Sand Pack (ft bls)	Depth to Top of Bentonite Slurry (ft bls)	Measuring Point Elevation*		Depth to Top of Bedrock (ft bls)	Top of Bedrock Elevation (ft bls)
								Ground	Top of PVC		
<u>Bedrock</u>											
GMMW21D	12/8/94	4	PVC	107.0	97.0 - 107.0	93.0	89.0	10.9	12.43	110.0	-99.1
GMMW22D	12/16/94	4	PVC	120.0	110.0 - 120.0	108.0	105.0	10.7	10.37	120.0	-109.30
GMMW23D	12/29/94	4	PVC	110.0	100.0 - 110.0	98.0	90.0	15.3	15.29	117.0	-101.70
GMMW24D	11/30/94	4	PVC	128.0	118.0 - 128.0	115.0	112.0	9.4	8.85	129.0	-119.6

* Based on National Geodetic Vertical Datum 1929.
PVC Polyvinyl chloride.
NA Not applicable.
ft bls Feet below land surface.
IRM Interim Remedial Measure.
NAPL Non-aqueous phase liquid.

Note: A summary of monitoring well construction details for IRM monitoring wells in the General Tank Field, No. 3 Tank Field, Exxon Chemical Plant (Utilities Area) and Lube Oil Area, was provided in the NAPL IRM Investigation Report (Geraghty & Miller, Inc., 1995a).



Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

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Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Phase IA RI Monitoring Wells														
Shallow														
GMMW1	9.70	0.885	11:45	3.39	4.16	0.77	6.22	16:55	3.42	4.19	0.77	6.19	-0.03	GMMW1 ⁽²⁾
GMMW2	17.44	NA	11:20	NA	3.92	NA	13.52	17:04	NA	3.95	NA	13.49	-0.03	
GMMW3	15.17	0.970	9:53	8.18	8.19	0.01	6.99	15:12	NA	8.20	NA	6.97	-0.02	ECPSB2 ⁽³⁾
GMMW4	9.72	0.853	10:08	5.30	5.305	0.005	4.42	15:24	NA	5.33	NA	4.39	-0.03	GMMW5 ⁽³⁾
GMMW5	9.26	0.853	11:58	2.69	7.36	4.67	5.88	16:00	2.64	7.31	4.67	5.93	0.05	GMMW5 ⁽²⁾
GMMW6	14.43	NA	10:22	NA	10.05	NA	4.38	14:43	NA	10.1	NA	4.36	-0.02	
GMMW7	8.36	0.841	11:42	2.70	7.51	4.81	4.90	15:56	2.64	7.57	4.93	4.94	0.04	GMMW7 ⁽²⁾
GMMW8	8.80	NA	12:39	NA	4.62	NA	4.18	16:27	NA	4.60	NA	4.20	0.02	
GMMW9	7.91	NA	12:30	NA	4.89	NA	3.02	16:22	NA	4.90	NA	3.01	-0.01	
GMMW10	8.88	NA	13:01	NA	4.66	NA	4.22	16:38	NA	4.63	NA	4.25	0.03	
GMMW11	11.58	NA	12:16	NA	6.59	NA	4.99	16:14	NA	6.57	NA	5.01	0.02	
GMMW12	13.73	0.916	10:28	7.24	7.35	0.11	6.48	15:55	7.23	7.26	0.03	6.50	0.02	SSB1 ⁽²⁾
GMMW13	11.85	0.885	11:35	4.00	4.02	0.02	7.85	16:47	NA	4.02	NA	7.83	-0.02	GMMW1 ⁽³⁾
GMMW14	9.30	NA	13:26	NA	3.85	NA	5.45	17:03	NA	3.81	NA	5.49	0.04	
GMMW15	9.45	NA	10:10	NA	7.10	NA	2.35	15:27	NA	6.90	NA	2.55	0.20	
GMMW16	11.61	0.830	11:24	5.76	9.88	4.12	5.15	15:42	5.76	9.84	4.08	5.16	0.01	GMMW16 ⁽²⁾
GMMW17	10.91	NA	11:08	NA	4.83	NA	6.08	15:37	NA	4.88	NA	6.03	-0.05	
GMMW18	15.09	0.870	11:40	6.99	7.94	0.95	7.98	16:50	7.00	7.92	0.92	7.97	-0.01	
GMMW19	11.12	0.853	11:30	5.85	5.86	0.01	5.27	16:45	NA	5.78	NA	5.34	0.07	GMMW5 ⁽³⁾
GMMW20	8.22	NA	12:47	NA	5.05	NA	3.17	16:32	NA	5.04	NA	3.18	0.01	
Intermediate														
GMMW211	13.20	NA	10:23	NA	12.98	NA	0.22	15:06	NA	10.6	NA	2.59	2.37	
GMMW231	15.14	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	
GMM2241	8.93	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	

See last page for footnotes.

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Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

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Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Phase IA RI Monitoring Wells (continued)														
<u>Deep</u>														
GMMW21D	12.43	NA	10:19	NA	11.94	NA	0.49	15:05	NA	9.39	NA	3.04	2.55	
GMMW22D	10.37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	
GMMW23D	15.29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	
GMMW24D	8.85	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	
<u>Surface-Water Measuring Point</u>														
SWMP1	3.36	NA	13:13	NA	2.5	NA	0.86	16:48	NA	1.45	NA	1.91	1.05	
SWMP2	7.04	--	--	--	--	--	--	--	--	--	--	--	--	
SWMP3	10.21	NA	10:03	NA	11.34	NA	-1.13	15:08	NA	8.04	NA	2.17	3.30	
SWMP4	9.85	NA	10:04	NA	10.89	NA	-1.04	15:28	NA	7.28	NA	2.37	3.41	
SWMP5	8.27	NA	9:35	NA	9.14	NA	-0.87	15:29	NA	6.01	NA	2.26	3.13	
SWMP6	9.91	NA	10:50	NA	11.22	NA	-1.31	16:18	NA	7.74	NA	2.17	3.48	
SWMP7	11.42	NA	11:43	NA	12.68	NA	-1.26	16:59	NA	9.97	NA	1.45	2.71	
<u>Existing Monitoring Wells</u>														
<u>Shallow</u>														
EB1	8.92	0.901	10:24	5.81	5.82	0.01	3.11	15:07	NA	5.80	NA	3.12	0.01	EB2 ⁽²⁾
EB2	8.93	0.901	9:15	8.10	9.15	1.05	0.73	15:11	7.48	8.53	1.05	1.35	0.62	EB2 ⁽²⁾
EB3	8.96	0.901	9:17	7.67	8.75	1.08	1.18	15:15	7.58	8.62	1.04	1.28	0.09	EB2 ⁽²⁾
EB4	9.01	0.901	9:20	8.05	8.72	0.67	0.89	15:17	7.39	8.03	0.64	1.56	0.66	EB2 ⁽²⁾
EB5	9.09	0.901	9:23	8.20	8.58	0.38	0.85	15:20	7.58	7.97	0.39	1.47	0.62	EB2 ⁽²⁾
EB6	9.20	0.901	9:25	7.79	7.80	0.01	1.41	15:23	NA	7.93	NA	1.27	-0.14	EB2 ⁽²⁾
EB7	8.87	0.885	9:30	7.71	7.74	0.03	1.16	15:25	7.77	7.78	0.01	1.10	-0.06	EBR5 ⁽³⁾
EB8	8.12	NA	9:32	NA	8.92	NA	-0.80	15:27	NA	5.94	NA	2.18	2.98	

See last page for footnotes.

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Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

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Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Existing Monitoring Wells (continued)														
Shallow														
† EB9	8.81	0.901	9:39	6.91	8.40	1.49	1.75	15:30	6.82	8.44	1.62	1.83	0.08	EB2 ⁽²⁾
EB10	8.78	0.885	9:49	4.32	7.42	3.1	4.10	15:36	4.34	7.41	3.07	4.09	-0.02	EBR5 ⁽³⁾
EB11	9.30	—	—	3.60	—	—	—	16:03	3.61	—	—	—	—	Well caved in.
EB12	9.53	0.910	10:40	0.92	5.10	4.18	8.23	16:07	0.60	4.55	3.95	8.57	0.34	
† EB13	9.68	0.995	9:58	4.15	4.67	0.52	5.53	15:44	4.10	4.82	0.72	5.58	0.05	EB13 ⁽²⁾
EB14	11.01	NA	10:56	NA	8.29	NA	2.72	16:20	NA	8.31	NA	2.70	-0.02	
† EB15	9.74	NA	11:07	NA	9.44	NA	0.30	16:25	NA	7.69	NA	2.05	1.75	
EB16	12.56	0.885	11:15	11.02	12.73	1.71	1.34	16:42	11.02	12.8	1.73	1.34	0.00	EB16 ⁽²⁾
EB17	12.36	0.918	12:08	2.03	2.05	0.02	10.33	17:17	2.06	2.08	0.02	10.30	-0.03	EB17 ⁽²⁾
EB19	9.67	0.907	11:16	4.23	6.24	2.01	5.25	16:32	4.25	6.08	1.83	5.25	0.00	EB19 ⁽²⁾
EB22	13.31	0.895	10:20	2.80	3.05	0.25	10.48	15:47	2.78	3.03	0.25	10.50	0.02	EB24 ⁽²⁾
EB23	14.73	0.895	9:59	2.93	3.09	0.16	11.78	15:40	2.92	3.07	0.15	11.79	0.01	EB24 ⁽²⁾
EB24	15.82	0.895	9:53	5.27	5.40	0.13	10.54	15:36	5.25	5.37	0.12	10.56	0.02	EB24 ⁽²⁾
EB25	13.76	0.820	9:47	3.09	3.11	0.02	10.67	15:32	3.10	3.13	0.03	10.65	-0.01	AHTFSB1 ⁽²⁾
EB26	15.99	NA	9:42	NA	3.61	NA	12.38	15:28	NA	3.63	NA	12.36	-0.02	
EB27	16.23	NA	9:38	NA	5.11	NA	11.12	15:25	NA	5.16	NA	11.07	-0.05	
EB28	16.06	0.820	9:31	5.90	5.91	0.01	10.16	15:21	5.73	5.74	0.01	10.32	0.16	AHTFSB1 ⁽²⁾
EB29	17.74	0.820	9:24	2.05	2.06	0.01	15.89	15:15	NA	2.10	NA	15.84	-0.05	AHTFSB1 ⁽²⁾
EB30	13.05	0.820	9:27	3.37	3.38	0.01	9.68	15:18	NA	3.39	NA	9.66	-0.02	AHTFSB1 ⁽²⁾
EB31	16.76	NA	9:12	NA	8.92	NA	7.84	15:11	NA	9.00	NA	7.76	-0.08	
EB33	11.05	NA	9:39	NA	8.13	NA	2.92	15:02	NA	8.17	NA	2.88	-0.04	
EB34	12.84	0.971	9:33	8.56	8.83	0.27	4.27	14:58	8.54	8.75	0.21	4.29	0.02	ITMW4 ⁽²⁾
EB35	10.62	NA	9:37	NA	6.56	Trace	4.06	15:12	NA	6.60	NA	4.02	-0.04	
EB36	8.09	0.971	9:51	2.66	5.53	2.87	5.35	15:04	2.71	—	—	—	—	Dry
EB40	10.89	0.971	9:47	8.14	8.27	0.13	2.75	15:15	8.17	8.23	0.06	2.72	-0.03	ITMW4 ⁽²⁾

See last page for footnotes.

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Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

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Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Existing Monitoring Wells (continued)														
Shallow														
EB41	9.84	0.971	10:01	7.35	7.39	0.04	2.49	15:07	7.37	7.38	0.01	2.47	-0.02	ITMW4 ⁽³⁾
EB42	12.01	0.971	10:11	9.81	9.91	0.1	2.20	15:25	9.82	9.93	0.11	2.19	-0.01	ITMW4 ⁽²⁾
EB44	11.18	NA	10:15	NA	8.92	NA	2.26	15:28	NA	8.88	NA	2.3	0.04	Trace
EB47	9.83	NA	9:20	NA	6.33	NA	3.50	15:07	NA	6.33	NA	3.50	0.00	
EB48	9.06	NA	9:22	NA	6.32	NA	2.74	15:08	NA	6.37	NA	2.69	-0.05	
EB49	10.62	NA	9:24	NA	6.42	NA	2.20	15:09	NA	6.47	NA	2.15	-0.05	
EB50	10.91	0.862	9:40	6.51	6.78	0.27	4.36	15:12	6.52	6.67	0.15	4.37	0.01	EB59 ⁽²⁾
EB51	10.21	NA	9:39	NA	5.72	NA	4.49	15:11	NA	5.74	NA	4.47	-0.02	
EB52	10.53	0.862	9:34	6.94	10.01	3.07	3.17	15:17	6.89	10	3.13	3.21	0.04	EB59 ⁽²⁾
EB53	8.73	0.862	9:55	2.75	2.76	0.01	5.98	15:33	2.74	2.75	0.01	5.99	0.01	EB59 ⁽²⁾
EB54	8.48	NA	8:53	NA	2.33	NA	6.15	15:34	NA	2.34	NA	6.14	-0.01	
EB56	8.90	NA	9:57	NA	4.27	NA	4.63	15:37	NA	4.27	NA	4.63	0.00	
EB57	8.14	NA	10:12	NA	4.46	NA	3.68	15:36	NA	4.44	NA	3.70	0.02	
EB58	8.94	0.862	10:07	6.31	6.52	0.21	2.80	15:42	6.33	6.51	2.18	2.31	-0.29	EB59 ⁽³⁾
EB59	10.41	0.862	10:14	7.66	8.67	1.01	2.61	15:45	7.14	7.97	0.83	3.16	0.54	EB59 ⁽²⁾
EB60R	11.37	0.862	10:22	12.11	13.38	1.27	-0.92	15:52	8.51	11.7	3.23	2.41	3.33	EB59 ⁽³⁾
EB61	10.59	0.862	10:37	8.84	9.05	0.21	1.72	15:56	8.51	8.80	0.29	2.04	0.32	EB59 ⁽²⁾
EB62	10.83	0.991	10:37	11.54	13.99	2.45	-0.73	15:58	8.42	10.8	2.33	2.39	3.12	EB59 ⁽³⁾
EB63	10.11	NA	10:40	NA	8.29	NA	1.82	16:00	NA	8.13	NA	1.98	0.16	
EB64	9.25	0.862	10:05	7.28	7.54	0.26	1.93	15:41	7.37	7.58	0.21	1.85	-0.08	EB59 ⁽³⁾
EB65	12.46	0.862	10:16	12.14	15.18	3.04	-0.10	15:47	9.88	11.7	1.86	2.32	2.42	EB59 ⁽³⁾
EB66R	11.98	0.862	10:23	12.75	13.19	0.44	-0.83	15:50	9.69	10.1	0.39	2.24	3.07	EB59 ⁽²⁾
EB67	10.57	0.991	10:50	10.95	12.17	1.22	-0.39	16:12	7.90	10.40	2.5	2.65	3.04	EB59 ⁽³⁾
EB68	11.52	NA	10:48	NA	12.25	NA	-0.73	16:10	NA	9.16	NA	2.36	3.09	
EB69	11.47	0.990	10:44	12.33	15.90	3.57	-0.90	16:05	9.15	11.4	2.29	2.30	3.19	EB69 ⁽²⁾

See last page for footnotes.

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Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (15:15)					Water Level ¹¹ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Existing Monitoring Wells (continued)														
<u>Shallow</u>														
† EB70	--	--	--	--	--	--	--	--	--	--	--	--	--	Buried Well
EB71	12.15	0.852	9:56	10.56	10.57	0.01	1.59	15:21	10.58	10.6	Trace	1.57	-0.02	EBR18 ⁽²⁾
EB72	12.27	0.94	9:50	10.69	11.33	0.64	1.54	15:49	10.66	11.10	0.44	1.58	0.04	EB72 ⁽²⁾
† EB73	11.51	0.94	9:39	9.81	10.35	0.54	1.67	15:16	9.76	10.3	0.57	1.72	0.05	EB73 ⁽²⁾
† EB74	12.01	0.94	9:34	10.68	10.73	0.05	1.33	15:10	10.7	10.8	0.07	1.31	-0.02	EB73 ⁽²⁾
EB75	13.47	NA	10:42	NA	6.64	NA	6.83	16:00	NA	6.55	NA	6.92	0.09	
EB76	11.88	0.889	10:43	7.50	8.24	0.74	4.30	16:15	7.58	8.20	0.62	3.68	-0.62	EB76 ⁽²⁾
EB77	10.94	0.802	--	7.11	16.86	9.75	1.90	16:01	6.63	16.8	10.13	2.30	0.40	MW13 ⁽³⁾
EB78	11.50	0.802	13:10	7.23	14.40	7.17	2.85	15:47	7.16	14.3	7.16	2.92	0.07	MW13 ⁽³⁾
EB79	12.34	0.832	13:22	8.50	15.08	6.58	2.73	15:49	8.19	14.9	7.69	3.03	0.29	MW8 ⁽³⁾
EB80	13.21	0.800	13:30	8.92	12.82	3.9	3.51	16:27	8.86	12.70	3.84	3.58	0.07	EB80 ⁽²⁾
EB81	13.04	0.990	13:32	3.05	3.20	0.15	9.99	16:29	3.09	3.23	0.14	9.95	-0.04	EB81 ⁽²⁾
EB82	10.70	NA	10:00	NA	8.62	NA	2.08	15:39	NA	8.48	NA	2.22	0.14	
† EB83	11.58	NA	9:43	NA	6.63	NA	4.95	15:03	NA	6.64	NA	4.94	-0.01	
† EB84	8.98	NA	9:48	NA	4.24	NA	4.74	15:30	NA	4.23	NA	4.75	0.01	
EB85	NS	NA	9:17	NA	8.94	NA	NA	14:56	NA	7.94	NA	NA	NA	
EB87	8.60	NA	11:36	NA	0.62	NA	7.98	16:07	NA	0.65	NA	7.95	-0.03	
EB88	8.24	NA	11:33	NA	0.49	NA	7.75	16:10	NA	0.46	NA	7.79	0.04	
† EB89	9.08	--	11:39	--	--	NA	--	16:05	--	--	NA	--	--	Casing blocked.
† EB90	9.45	NA	11:09	NA	5.45	NA	4.00	16:30	NA	5.45	NA	4.00	0.00	
EB91	9.20	NA	11:46	NA	5.86	NA	3.34	16:00	NA	5.89	NA	3.31	-0.03	
EB92	8.56	0.917	11:49	5.68	5.74	0.08	2.89	15:58	5.66	5.75	0.09	2.89	0.00	EB104 ⁽²⁾
EB93	9.48	NA	11:54	NA	5.43	NA	4.05	15:53	NA	6.45	NA	3.03	-1.02	
EB94	7.52	0.870	12:00	5.81	5.88	0.07	1.70	15:49	5.84	5.89	0.05	1.67	-0.03	ITMW2 ⁽³⁾
EB95	7.82	0.870	10:37	5.96	6.10	0.14	1.84	15:46	5.97	5.99	0.02	1.85	0.01	ITMW2 ⁽³⁾
EB96	7.71	0.870	10:35	6.49	6.58	0.09	1.21	15:44	6.46	6.53	0.07	--	--	No water.

See last page for footnotes.

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Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

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Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Existing Monitoring Wells (continued)														
Shallow														
EB97	6.54	--	11:45	5.87	--	NA	--	15:42	5.87	--	--	--	--	Casing blocked.
EB98	10.90	NA	10:23	NA	9.21	NA	1.69	16:21	NA	9.20	NA	1.70	0.01	
EB99	8.95	NA	11:43	NA	2.76	NA	6.19	16:01	NA	2.71	NA	6.24	0.05	Dry well.
EB100	NS	--	10:37	--	--	NA	--	16:51	--	--	--	--	--	
EB101	NS	0.917	10:13	9.43	9.45	0.02	NA	16:50	NA	9.43	NA	NA	NA	
EB102	NS	0.917	10:10	9.59	9.60	0.01	NA	16:48	NA	9.71	NA	NA	NA	
EB103	NS	0.917	10:07	8.69	8.70	0.01	NA	16:46	8.7	8.71	0.01	NA	NA	
EB104	NS	0.917	10:03	9.00	9.73	0.73	NA	16:45	9.01	9.62	0.61	NA	NA	
EB105	NS	0.917	9:39	8.97	9.94	0.97	NA	16:43	8.96	9.61	0.65	NA	NA	
EB106	NS	0.927	9:35	8.45	9.15	0.7	NA	16:41	9.1	9.49	0.39	NA	NA	
EBR1	13.83	0.995	10:12	12.50	12.51	0.01	1.33	15:55	12.51	12.5	0.01	1.32	-0.01	EB813 ⁽²⁾
EBR2	8.93	0.901	10:26	9.30	9.31	0.01	-0.37	15:09	7.59	7.80	0.01	1.34	1.71	EB2 ⁽³⁾
EBR4	8.58	0.885	9:44	7.20	8.84	1.64	1.19	15:37	6.89	8.73	1.84	1.48	0.29	EBR5 ⁽²⁾
EBR5	8.60	0.885	9:47	7.15	8.85	1.7	1.25	15:34	6.94	8.81	1.87	1.44	0.19	EBR5 ⁽²⁾
EBR6	10.38	0.885	10:04	4.90	5.42	0.52	5.42	15:50	4.9	5.19	0.29	5.45	0.03	EBR5 ⁽²⁾
EBR7	9.84	NA	10:35	NA	3.00	NA	6.64	16:07	NA	3.05	NA	6.59	-0.05	Sheen
EBR8	9.46	0.885	9:53	4.19	5.99	1.8	5.06	15:40	4.19	6.04	1.85	5.06	-0.01	EBR5 ⁽²⁾
† EBR9	8.69	NA	9:25	NA	7.37	NA	1.32	15:10	NA	7.09	NA	1.60	0.28	EB59 ⁽³⁾
EBR10	9.30	0.862	9:27	7.87	7.88	0.01	1.43	15:20	8.00	8.01	0.01	1.30	-0.13	
EBR11	9.24	NA	9:43	NA	19.95	NA	-10.71	15:22	NA	8.62	NA	0.62	11.33	
EBR12	10.04	0.865	9:19	8.96	9.99	1.03	0.94	15:00	8.37	9.43	1.06	1.53	0.59	EBR12 ⁽²⁾
EBR13	10.06	NA	9:21	NA	8.74	NA	1.32	15:04	NA	8.54	NA	1.52	0.20	
EBR14	10.05	NA	9:25	NA	8.84	NA	1.21	15:05	NA	8.50	NA	1.55	0.34	
EBR15	9.52	NA	9:27	NA	7.83	NA	1.69	15:05	NA	7.84	NA	1.68	-0.01	
EBR16	10.29	--	9:30	--	--	NA	--	15:08	NA	8.82	NA	1.47	NA	
† EBR17	9.88	NA	9:33	NA	7.69	NA	1.99	15:09	7.77	7.80	0.03	1.85	-0.14	EBR18 ⁽²⁾

See last page for footnotes.

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Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

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Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Existing Monitoring Wells (continued)														
Shallow														
EBR18	11.44	0.852	9:35	9.94	10.99	1.05	1.34	15:09	9.82	10.9	1.06	1.46	0.12	
EBR19	9.54	NA	9:37	NA	6.64	NA	2.90	15:14	NA	6.62	NA	2.92	0.02	
EBR21	10.12	NA	9:40	NA	8.41	NA	1.71	15:18	8.44	8.44	Trace	1.68	-0.03	
EBR22	10.10	0.885	12:00	8.02	8.03	0.01	2.07	17:10	NA	7.92	NA	2.18	0.11	
EBR23	9.50	NA	9:42	NA	6.62	NA	2.88	15:15	NA	6.75	NA	2.75	-0.13	
ITMW1	13.85	0.830	11:08	7.95	17.85	9.9	4.22	16:55	7.78	17.70	9.92	4.38	0.17	
ITMW2	15.28	0.870	10:38	11.77	14.75	2.98	3.12	16:24	11.71	14.8	3.13	3.16	0.04	ITMW2 ⁽²⁾
ITMW3	15.50	0.870	10:40	11.98	14.71	2.73	3.17	16:26	11.97	14.8	2.8	3.17	0.00	ITMW2 ⁽²⁾
ITMW4	10.20	0.971	10:06	6.52	6.77	0.25	3.67	15:21	6.49	6.77	0.28	3.70	0.03	ITMW4 ⁽²⁾
ITMW5	8.56	NA	9:58	NA	2.89	NA	5.66	15:19	NA	2.96	NA	5.59	-0.07	
ITMW6	11.76	NA	9:28	NA	7.51	NA	4.26	14:55	NA	7.43	NA	4.33	0.08	
MW1	15.57	0.970	9:12	7.34	8.22	0.88	8.20	15:02	7.36	8.22	0.86	8.18	-0.02	ECPSB2 ⁽²⁾
MW2	15.65	0.970	9:28	7.22	7.56	0.34	8.42	15:06	7.33	7.63	0.3	8.31	-0.11	ECPSB2 ⁽²⁾
MW3	12.06	0.807	10:35	7.50	15.24	7.74	3.06	16:03	7.47	16.2	8.68	2.91	-0.15	MW3 ⁽²⁾
MW4	9.10	0.802	11:04	3.58	3.60	0.02	5.52	15:35	NA	3.56	NA	5.54	0.02	MW13 ⁽²⁾
MW6	11.23	NA	10:56	NA	5.32	NA	5.91	15:31	NA	5.43	NA	5.80	-0.11	
MW7	12.00	0.790	13:50	6.45	7.83	1.38	5.26	16:38	6.30	7.68	1.38	5.41	0.15	MW7 ⁽²⁾
MW8	12.35	0.832	13:45	7.73	21.33	13.6	2.34	16:25	7.61	17.4	9.74	3.1	0.77	MW8 ⁽²⁾
MW9	9.02	NA	11:10	NA	3.63	NA	5.39	15:37	NA	3.61	NA	5.41	0.02	
MW10	11.54	NA	13:40	NA	4.50	NA	7.04	16:47	NA	4.91	NA	6.63	-0.41	
MW11	10.73	NA	13:40	NA	4.85	NA	5.88	16:55	NA	4.89	NA	5.84	-0.04	
MW12	10.24	0.797	12:56	8.02	14.55	8.53	2.49	16:32	6.03	14.5	8.46	2.49	0.00	MW12 ⁽²⁾
MW13	11.66	0.802	-	7.75	17.89	10.14	1.90	15:59	7.48	17.9	10.41	2.12	0.22	MW13 ⁽²⁾
MW14	11.59	NA	13:05	NA	6.24	NA	5.35	15:46	NA	6.25	NA	5.34	-0.01	

See last page for footnotes.

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Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Existing Monitoring Wells (continued)														
Shallow														
PKMW1	9.35	0.907	11:26	4.42	5.81	1.39	4.80	16:38	4.40	5.79	1.39	4.82	0.02	EB19 ⁽³⁾
PKMW2	12.29	NA	11:06	NA	7.17	NA	5.12	16:27	NA	7.16	NA	5.13	0.01	
PKMW3	8.73	0.907	11:51	4.56	4.95	0.39	4.13	17:05	4.69	4.98	0.29	4.01	-0.12	EB19 ⁽³⁾
PKMW4	11.99	0.907	11:41	11.50	11.51	0.01	0.49	16:58	10.01	10	0.01	1.98	1.49	EB19 ⁽³⁾
PKMW5	12.33	NA	11:10	NA	12.42	NA	-0.09	16:33	NA	10.3	NA	2.02	2.11	
PKMW6	12.28	NA	11:05	NA	9.30	NA	2.98	16:30	NA	1.63 **	NA	10.65	7.67 **	
PKMW7	13.46	0.885	11:01	NA	11.54	NA	1.92	16:28	11.44	11.5	0.04	2.02	0.10	EB16 ⁽³⁾
PKMW8	13.09	0.945	10:38	5.34	5.55	0.21	7.74	16:02	5.32	5.64	0.32	7.75	0.01	PKMW8 ⁽²⁾
PKMW9	12.72	NA	10:57	NA	5.96	NA	6.76	16:20	NA	5.93	NA	6.79	0.03	
P7MW1	10.84	0.991	10:25	11.60	13.32	1.72	-0.78	15:51	8.36	10	1.66	2.47	3.24	EB62 ⁽³⁾
P7MW2	12.88	0.862	10:32	13.42	15.35	1.93	-0.81	15:49	10.21	12.1	1.87	2.41	3.22	EB59 ⁽³⁾
P6T65	NS	NA	9:28	NA	10.81	NA	NA	15:07	NS	7.80	NA	NA	NA	
SHERI1	NS	NA	9:23	NA	9.84	NA	NA	15:03	NA	9.89	NA	NA	NA	
SHERI2	NS	0.852	9:32	11.09	11.10	0.01	NA	15:02	11.13	11.1	Trace	NA	NA	EBR18 ⁽³⁾
SHERI3 ***	NS	0.936	9:37	12.27	12.77	0.5	NA	15:16	11.92	12.4	0.52	NA	NA	
VER1	12.37	0.807	13:15	8.49	19.10	10.61	1.83	15:55	7.75	18	10.24	2.64	0.81	MW3 ⁽³⁾
VER2	13.60	0.807	13:20	9.39	22.22	12.83	1.73	15:52	8.94	20.8	11.84	2.37	0.64	MW3 ⁽³⁾

See last page for footnotes.



Table 4-1. Summary of Water-Level Measurements Collected on December 12, 1994, Bayonne Plant, Bayonne, New Jersey.

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Well Designation	Measuring Point Elevation (ft msl)	Product Density (gm/mL)	Low Tide (10:18)					High Tide (16:15)					Water Level ⁽¹⁾ Difference with Rising Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable) (ft msl)		
Existing Monitoring Wells (continued)														
Intermediate														
PKMW10	12.48	NA	11:01	NA	11.92	NA	0.56	16:23	NA	11.2	NA	1.26	0.70	
PKMW11	10.32	0.882	11:30	8.96	18.25	9.29	0.26	16:48	7.92	17.7	9.8	1.24	0.98	PKMW11 ⁽²⁾
PKMW12	8.96	0.870	11:49	7.42	16.76	9.34	0.33	17:00	6.35	16.3	9.93	1.32	0.99	PKMW12 ⁽²⁾
PKMW13	11.98	NA	11:38	NA	12.04	NA	-0.06	16:50	NA	10.8	NA	1.23	1.29	
PKMW14	12.77	0.920	10:52	11.86	12.61	0.75	0.85	16:15	11.40	12.2	0.75	1.31	0.46	PKMW14 ⁽²⁾
PKMW15	12.28	NA	10:48	NA	10.93	NA	1.35	16:12	NA	10.7	NA	1.59	0.24	

gm/mL Gram per milliliter.

ft msl Feet above mean sea level.

ft bmp Feet below measuring point.

⁽¹⁾ Positive water-level differences indicate water-level increase with rising tide. Negative water-level differences indicate water-level decrease with rising tide.⁽²⁾ Density determined by hydrometer analysis at this location.⁽³⁾ Well was used on basis for product density determination; density estimated by hydrometer analysis.

NA Not applicable.

NI Not installed.

NS Not surveyed.

- Measurement not taken.

* Low tide water level for Monitoring Well EBR11 was low due to active pumping from this well.

** Anomalous values.

*** Pump in well on.

† These wells are scheduled to be abandoned.



Table 4-2. Summary of Water-Level Measurements Collected on April 17, 1995, Bayonne Plant, Bayonne, New Jersey.

Well Designation	Measuring-Point Elevation (ft msl)	Product Density (gm/mL)	High Tide (9:05 a.m.)					Low Tide (2:30 p.m.)					Water-Level ⁽¹⁾ Difference with the Falling Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable)		
Phase IA RI Monitoring Wells														
Shallow														
GMMW1	9.70	0.885	9:50	3.87	4.35	0.48	5.77	3:06	3.84	4.32	0.48	5.80	0.03	GMMW1 ⁽²⁾
GMMW3	15.17	0.970	10:10	9.27	9.71	0.44	5.89	3:29	9.32	9.68	0.36	5.84	-0.05	ECPSB2 ⁽³⁾
Intermediate														
GMMW21I	13.20	NA	9:38	NA	9.48	NA	3.72	2:57	NA	12.57	NA	0.63	-3.09	
GMMW23I	15.14	NA	10:07	NA	12.17	NA	2.97	3:25	NA	12.11	NA	3.03	0.06	
GMM24I	8.93	NA	10:28	NA	6.40	NA	2.53	3:41	NA	8.70	NA	0.23	-2.30	
Deep														
GMMW21D	12.43	NA	9:41	NA	8.60	NA	3.83	2:59	NA	13.44	NA	-1.01	-4.84	
GMMW22D	10.37	NA	9:55	NA	7.56	NA	2.81	3:09	NA	7.74	NA	2.63	-0.18	
GMMW23D	15.29	NA	10:03	NA	12.04	NA	3.25	3:23	NA	12.94	NA	2.36	-0.90	
GMMW24D	8.85	NA	10:25	NA	4.67	NA	4.18	3:42	NA	8.80	NA	0.05	-4.13	
Existing Monitoring Wells														
Shallow														
EB1	8.92	0.901	9:39	NA	7.11	1.81	3.44	2:55	8.89	8.90	0.01	2.02	-1.42	EB2 ⁽²⁾
EB25*	13.76	0.820	11:20	3.65	3.67	0.02	10.11	--	--	--	--	--	--	AHTFSB1 ⁽²⁾
EB26*	15.17	NA	11:49	4.15	4.16	0.01	11.01	--	--	--	--	--	--	
EB27*	16.23	NA	10:45	5.84	5.65	0.01	10.58	--	--	--	--	--	--	
EB28*	16.06	0.820	10:54	6.29	6.30	0.01	9.77	--	--	--	--	--	--	AHTFSB1 ⁽²⁾
EB29*	17.74	0.820	11:00	NA	3.04	NA	14.70	--	--	--	--	--	--	AHTFSB1 ⁽²⁾
EB30*	13.05	0.820	11:13	NA	2.67	NA	10.38	--	--	--	--	--	--	AHTFSB1 ⁽²⁾
EBR13	10.06	NA	--	8.16	8.18	0.02	1.88	3:43	8.98	9.00	0.02	1.06	-0.82	Trace of product

See last page for footnotes.

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Table 4-2. Summary of Water-Level Measurements Collected on April 17, 1995, Bayonne Plant, Bayonne, New Jersey.

Well Designation	Measuring-Point Elevation (ft msl)	Product Density (gm/mL)	High Tide (9:05 a.m.)					Low Tide (2:30 p.m.)					Water-Level ⁽¹⁾ Difference with the Falling Tide	Comments
			Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable)	Measuring Time	Depth to Product (ft bmp)	Depth to Water (ft bmp)	Product Thickness (feet)	Water-Table Elevation (corrected where applicable)		
Existing Monitoring Wells (continued)														
Intermediate														
PKMW10	12.48	NA	9:12	NA	11.83	NA	0.65	2:37	NA	11.25	NA	1.23	0.58	Pump system in well PKMW12 ⁽²⁾
PKMW11	10.32	0.882	—	—	—	—	—	—	—	—	—	—	—	
PKMW12	8.96	0.870	9:15	7.0	16.30	9.30	0.75	7:40	6.79	16.30	9.51	0.93	0.18	
PKMW13	11.98	NA	9:20	NA	11.20	NA	0.78	2:42	NA	11.92	NA	0.06	-0.72	PKMW14 ⁽²⁾ EB59 ⁽²⁾
PKMW14	12.77	0.920	9:06	11.85	14.61	2.76	0.70	2:34	11.05	13.74	2.69	1.50	0.81	
PKMW15	12.28	NA	9:05	NA	11.28	NA	1.0	2:30	10.43	10.44	0.01	1.84	0.84	

gm/mL Gram per milliliter.

ft msl Feet above mean sea level.

ft bmp Feet below measuring point.

⁽¹⁾ Positive water-level differences indicate water-level decrease with falling tide.

Negative water-level differences indicate water-level increase with falling tide.

⁽²⁾ Density determined by hydrometer analysis at this location.⁽³⁾ Well was used on basis for product density determination; density estimated by hydrometer analysis.

NA Not applicable.

NS Not surveyed.

— Measurement not taken.

* Groundwater and product measurements from the "A"-Hill Tank Field area were collected after completion of the first round (high tide) of measurements. Only one round was taken.



Table 4-3. Horizontal Hydraulic Gradients, Bayonne Plant, Bayonne, New Jersey. *

Operational Area	Reference Points	Difference in Hydraulic Elevation (ft)	Difference in Horizontal Distance (ft)	Hydraulic Gradient (ft/ft)	Flow Direction
Solvent Tank Field	MW10 SWMP1	7	720	0.0097	Northeast
Solvent Tank Field	MW7 EB77	3	430	0.007	Southeast
Piers and East Side Treatment Plant Area	EB77 EBR12	2	1345	0.0015	East
No. 2 Tank Field	GMMW2 ITMW3	10	600	0.0167	Northeast
Main Building Area	EB28 EB98	9	770	0.0117	Northeast
Pier No. 1 Area	EB12 SWMP6	8	500	0.016	Southwest

- * Horizontal hydraulic gradients were calculated along lines drawn perpendicular to the hydraulic head contours shown on Figure 4-6. Lines for calculating the hydraulic gradients originated and terminated near the reference points listed above.



Table 4-4. Vertical Hydraulic Gradients, Bayonne Plant, Bayonne, New Jersey.

Well Pair (Screen Zone/ Open Interval)*	Vertical Distance Between Center Point of Screen/Open Interval (feet)	Groundwater Elevation Difference**	Vertical Gradient (feet/feet)	Vertical Gradient Direction
GMMW21I (Intermediate) GMMW21D (Deep)	66.6	1.64	0.025	Downward
GMMW23I (Intermediate) GMMW23D (Deep)	40.2	0.68	0.017	Downward
GMMW24I (Intermediate) GMMW24D (Deep)	88.6	0.18	0.002	Downward

* All monitoring wells were screened in the overburden material.

** Synoptic groundwater elevations measured on April 17, 1995. Measurements taken at low tide were used for all calculations.



Table 5-1. Total Petroleum Hydrocarbons in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample ID	Sample Date	Sample Depth (ft bls)	TPH Concentration (mg/kg)
<u>Samples With Concentrations Less Than 10,000</u>			
3TFIRMB3-04	10/6/94	04	2280
3TFIRMB3-14	10/6/94	14	295
3TFIRMB4-02	10/17/94	02	5340
AGTFSB3-02	10/27/94	02	7560
AHTFSB1-02	10/19/94	02	7150
AHTFSB2-02	10/14/94	02	4900
AHTFSB2-06	10/14/94	06	7360
APSB2-02	10/26/94	02	897
APSB2-06	10/26/94	06	1170
APSB4-04	10/21/94	04	3390
APSB5-02	10/12/94	02	2480
DTSB1-06	10/27/94	06	723
DTSB1-08	10/27/94	08	398
DTSB2-04	10/27/94	04	325
DTSB3-04FR2	10/27/94	04	683
ECIRMB1-02	10/24/94	02	671
ECPSB3-04	10/21/94	04	3950
EGTFSB1-04	10/27/94	04	5200
GTFIRMB1-02	10/5/94	02	501
GTFIRMB1-08	10/6/94	08	1980
GTFIRMB2-02	10/17/94	02	4320
GTFIRMB2-08	10/17/94	08	2550
GTFIRMB3-02	11/16/94	02	2870
GTFIRMB3-10	10/5/94	10	8640
GTFIRMB4-02	10/17/94	02	6680
GTFIRMB4-08	10/17/94	08	7190
GTFIRMB5-02	10/5/94	02	3130
GTFIRMB7-08	10/17/94	08	1460
GTFIRMB8-02	10/18/94	02	9670
GTFIRMB9-02	10/5/94	02	4320
GTFIRMB9-06	10/5/94	02	880
GTFSB1-02	10/10/94	02	5900
GTFSB2-02	10/13/94	02	2450
GTFSB3-02	10/10/94	02	776
GTFSB3-08	10/10/94	08	4600
GTFSB4-02	10/13/94	02	1940
GTFSB5-02	10/13/94	02	75.2
GTFSB5-08	10/13/94	08	5130
GTFSB6-02	10/11/94	02	5710
GTFSB7-02	10/13/94	02	3530
GFFSB8-02	10/18/94	02	9670
GTFSB9-02	10/13/94	02	4230
GTFSB9-06	10/5/94	06	880

See last page for footnotes.



Table 5-1. Total Petroleum Hydrocarbons in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample ID	Sample Date	Sample Depth (ft bls)	TPH Concentration (mg/kg)
<u>Samples With Concentrations Less Than 10,000 (continued)</u>			
LAIRMB1-02	10/24/94	02	5320
LAIRMB1-08	10/24/94	08	3460
LOS83-02	10/24/94	02	2850
LOS86-04	10/25/94	04	1520
LOS87-04	10/14/94	04	6030
LOS811-06	10/25/94	06	6920
LOS817-02	10/24/94	02	1820
LOS818-02	10/24/94	02	3370
MBSB2-06	10/21/94	06	9090
MDCSB1-04	10/26/94	04	9730
N2TFB1-04	10/12/94	04	6340
N2TFB2-02	10/19/94	02	520
N2TFB2-06	10/19/94	06	2750
N2TFB3-06	10/19/94	06	596
N2TFB3-10	10/19/94	10	8370
N2TFB6-04	10/19/94	04	453
N2TFB6-06	10/19/94	06	3650
N3TFB2-02	10/19/94	02	9210
N3TFB3-02	10/13/94	02	506
N3TFB4-06	10/17/94	06	1390
N3TFB5-04	10/19/94	04	1090
N3TFB6-06	10/18/94	06	8880
N3TFB8-02	10/18/94	02	4180
N3TFB9-02	11/2/94	02	675
PESTSB2-10	10/20/94	10	5270
PN1SB2-04	11/2/94	04	6060
SSB1-06	10/24/94	06	7900
SSB2-04	10/12/94	04	4280
SSB2-08	10/12/94	08	141
STFSB3-04	10/26/94	04	7180
T998SB1-08	10/12/94	08	1510
<u>Samples With Concentrations Greater Than 10,000 But Less Than 30,000</u>			
3TFIRMB4-06	10/17/94	06	13000
AGTFSB3-06	10/27/94	06	26600
AGTFSB4-02	10/20/94	02	19500
AHTFSB1-04	10/19/94	04	10100
AHTFSB4-02	10/14/94	02	15000
AHTFSB4-08	10/14/94	08	20900
APSB1-06	10/27/94	06	15100

See last page for footnotes.



Table 5-1. Total Petroleum Hydrocarbons in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample ID	Sample Date	Sample Depth (ft bls)	TPH Concentration (mg/kg)
Samples With Concentrations Greater Than 10,000 But Less Than 30,000 (continued)			
APSB1-10	10/27/94	10	22700
DTSB2-08	10/27/94	08	11500
EC2SB1-04	10/27/94	04	14800
EC2SB1-12	10/27/94	12	11900
ECIRMB1-06	10/24/94	06	17300
ECIRMB3-02	10/19/94	02	27300
ECPSB5-02	10/19/94	02	17200
GFSB1-02	10/12/94	02	14000
GFSB1-06	10/12/94	06	11200
GTFIRMB5-02FR	10/5/94	02	13600
GTFIRMB6-04	10/5/94	04	18400
GTFIRMB6-08	10/5/94	08	23600
GTFSB4-08	10/13/94	08	25000
GTFSB8-08	10/13/94	08	29400
LOSB3-04	10/24/94	04	13200
LOSB5-08	10/11/94	08	10600
LOSB8-08	10/24/94	08	11600
LOSB11-02	10/25/94	02	22900
LOSB14-02	10/25/94	02	11200
LOSB14-06	10/25/94	06	24100
LOSB15-02	10/24/94	02	28200
LOSB16-08	10/25/94	08	19200
MBSB1-02	10/25/94	02	28400
MBSB1-08	10/25/94	08	28500
MBSB2-02	10/21/94	02	11300
MBSB4-04	10/21/94	04	12400
MBSB4-10	10/21/94	10	19200
MDCSB2-03	10/11/94	03	14600
MDCSB1-08	10/26/94	08	14300
N2TFB1-08	10/12/94	08	16900
N2TFB5-02	10/19/94	02	29600
N3TFB4-02	10/17/94	02	19200
N3TFB5-08	10/19/94	08	10000
PN1SB2-08	11/2/94	08	12700
PSSB1-02	10/31/94	02	28800
SSB3-06	10/24/94	06	18100
SSB3-10	10/24/94	10	22400
STFSB2-04	10/26/94	04	13400
T998SB1-04	10/12/94	04	14300

See last page for footnotes.

Table 5-1. Total Petroleum Hydrocarbons in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample ID	Sample Date	Sample Depth (ft bls)	TPH Concentration (mg/kg)
<u>Samples With Concentrations Greater Than 30,000</u>			
AGTFSB1-02	10/20/94	02	69200
AGTFSB1-06	10/20/94	06	129000
AGTFSB2-04	10/28/94	04	53800
AGTFSB4-06	10/20/94	06	43000
AHTFSB3-06	10/20/94	06	41400
AHTFSB3-10	10/20/94	10	50600
APSB3-06	10/21/94	06	62100
APSB4-08	10/21/94	08	39700
APSB5-06	10/12/94	06	69000
APSB6-06	10/21/94	06	333000
APSB6-10	10/21/94	10	84700
DTSB3-04	10/27/94	04	74200
DTSB3-04FR1	10/27/94	04	76900
ECIRMB3-06	10/19/94	06	70500
ECPSB1-02	10/20/94	02	44500
ECPSB1-08	10/20/94	08	154000
ECPSB2-06	10/20/94	06	115000
ECPSB2-12	10/20/94	12	125000
ECPSB4-08	10/19/94	08	110000
ECPSB5-08	10/19/94	08	37400
GTFIRMB5-06	10/5/94	06	220000
GTFIRMB7-02	10/17/94	02	33600
GTFIRMB8-08	10/18/94	08	373000
GTFSB1-08	10/10/94	08	479000
GTFSB2-08	10/13/94	08	53500
GTFSB4-08FR	10/13/94	08	30300
GTFSB6-12	10/11/94	12	95400
GTFSB7-08	10/13/94	08	37300
GTFSB8-04	10/13/94	04	52300
GTFSB9-08	10/13/94	08	92200
LOSB1-04	10/25/94	04	86500
LOSB1-08	10/25/94	08	70800
LOSB2-04	10/14/94	04	109000
LOSB2-08	10/14/94	08	96800
LOSB4-02	10/24/94	02	46500
LOSB4-06	10/24/94	06	31700
LOSB5-04	10/11/94	04	51900
LOSB8-02	10/24/94	02	64500
LOSB9-02	10/25/94	02	53000
LOSB9-06	10/25/94	06	110000
LOSB10-04	10/28/94	04	41300
LOSB10-08	10/28/94	08	95900

See last page for footnotes.



Table 5-1. Total Petroleum Hydrocarbons in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample ID	Sample Date	Sample Depth (ft bls)	TPH Concentration (mg/kg)
<u>Samples With Concentrations Greater Than 30,000 (continued)</u>			
LOSB12-02	10/25/94	02	33200
LOSB12-06	10/25/94	06	47900
LOSB13-02	10/31/94	02	83700
LOSB13-02FR1	10/31/94	02	80600
LOSB13-02FR2	10/31/94	02	59100
LOSB13-08	10/31/94	08	81400
LOSB16-04	10/25/94	04	33000
LOSB18-08	10/24/94	08	371000
LOSB18-08FR	10/24/94	08	135000
MBSB3-06	10/25/94	06	47900
MBSB3-10	10/25/94	10	138000
MBSB3-10FR	10/25/94	10	164000
N2TFB4-02	10/28/94	02	49600
N2TFB4-06	10/28/94	06	82900
N2TFB5-06	10/19/94	06	93000
N3TFB1-02	10/18/94	02	61900
N3TFB1-12	10/18/94	12	44300
N3TFB2-06	10/19/94	06	43700
N3TFB2-06FR	10/19/94	06	85000
N3TFB3-08	10/13/94	08	36700
N3TFB6-02	10/18/94	02	126000
N3TFB7-02	10/18/94	02	166000
N3TFB7-06	10/18/94	06	65500
N3TFB8-06	10/18/94	06	146000
PESTSB1-04	10/20/94	04	34400
PSSB1-06	10/31/94	06	42000
SSB1-16	10/24/94	16	65400
STFSB1-02	10/26/94	02	72000
STFSB1-06	10/26/94	06	46500
STFSB2-08	10/26/94	08	51000
<u>Field Blanks</u>			
FBNA1-100594	10/5/94	--	0.3
FBNA2-100694	10/6/94	--	0.25U
FBNA3-101194	10/11/94	--	0.25U
FBNA4-101394	10/13/94	--	0.25U
FBNA5-101994	10/19/94	--	0.25U
FBNA6-102094	10/20/94	--	0.25U
FBNA7-102194	10/21/94	--	0.25U
FBNA7-102594	10/25/94	--	0.25U
FBNA8-102594	10/25/94	--	0.25U

See last page for footnotes.

Table 5-1. Total Petroleum Hydrocarbons in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample ID	Sample Date	Sample Depth (ft bls)	TPH Concentration (mg/kg)
Field Blanks (continued)			
FBNA9-102694	10/26/94	--	0.25U
FBNA10-102694	10/26/94	--	0.25U
FBNA11-102794	10/27/94	--	0.25U
FBNA12-102794	10/27/94	--	0.25U
FBNA13-102894	10/28/94	--	0.25U
FBNA14-102894	10/28/94	--	0.25U
FBNA15-102894	10/28/94	--	0.25U
FBNA16-102894	10/28/94	--	0.25U
FBNA17-103194	10/31/94	--	0.25U

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in milligrams per kilogram (mg/kg) (parts per million [ppm]).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using New Jersey Modified U.S. Environmental Protection Agency (USEPA) Method 418.1.

TPH Total petroleum hydrocarbons.
 FBNA Indicates a field blank associated with non-aqueous samples.
 FR Field replicate of previous sample.
 ft bls Feet below land surface
 mg/kg Milligrams per kilogram
 -- Not applicable.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: 3TFIRMB4	3TFIRMB4	AGTFSB1	AGTFSB1	AGTFSB2	AGTFSB3	AGTFSB3	AGTFSB4
	Impact to			Depth: 02	08	02	06	04	02	06	02
	Groundwater			Zone **: N3TF	N3TF	AGTF	AGTF	AGTF	AGTF	AGTF	AGTF
	Residential	Non-Residential		Date: 10/17/94	10/17/94	10/20/94	10/20/94	10/28/94	10/27/94	10/27/94	10/20/94
1,1,1-Trichloroethane	210000	1000000	50000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
1,1,2,2-Tetrachloroethane	34000	70000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
1,1,2-Trichloroethane	22000	420000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
1,1-Dichloroethane	570000	1000000	10000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
1,1-Dichloroethene	8000	150000	10000	12U	1400U	1600U	1600U	1400UJ	12U	61U	12U
1,2-Dibromoethane	--	--	--	24U	2900U	3200U	3200U	2800U	24U	120U	24U
1,2-Dichloroethane	6000	24000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
1,2-Dichloroethene(Total)	1079000	2000000	51000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
1,2-Dichloropropane	10000	43000	--	12U	1400U	1600UJ	1600U	1400UJ	12U	61U	12U
1-Butanol	--	--	--	600U	74000UJ	81000U	280000	71000UJ	600U	3000U	600U
2-Butanol	--	--	--	600U	74000UJ	81000U	81000U	71000U	600U	3000U	600U
2-Butanone	1000000	1000000	50000	12UJ	1400UJ	1600UJ	1600UJ	1400UJ	12U	61UJ	12UJ
2-Hexanone	--	--	--	12U	1400UJ	1600UJ	1600UJ	1400UJ	12U	61U	12U
2-Methyl-2-propanol	--	--	--	600U	74000UJ	81000U	81000U	71000UJ	600U	3000U	600U
2-Propanol	--	--	--	600U	74000UJ	81000U	81000U	71000U	600U	3000UJ	600UJ
4-Methyl-2-pentanone	1000000	1000000	50000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Acetone	1000000	1000000	100000	16U	1400UJ	1600UJ	1600UJ	1400UJ	18U	210UJ	32UJ
Benzene	3000	13000	1000	12U	1400U	1600U	1600U	1400U	12U	12J	4J
Bromodichloromethane	11000	48000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Bromoform	86000	370000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Bromomethane	79000	1000000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Carbon disulfide	--	--	--	12U	1400UJ	1600U	1600U	1400UJ	12U	61U	12U
Carbon tetrachloride	2000	4000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Chlorobenzene	37000	680000	1000	12U	190J	1600U	1600U	1400U	12U	61U	12U
Chloroethane	--	--	--	12U	1400UJ	1600U	1600UJ	1400U	12U	61U	12U
Chloroform	19000	28000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Chloromethane	520000	1000000	10000	12UJ	1400UJ	1600UJ	1600UJ	1400UJ	12U	61U	12U
Dibromochloromethane	110000	1000000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Ethylbenzene	1000000	1000000	100000	12U	1400U	1600U	1600U	190J	12U	61U	1J
Hexane	--	--	--	24U	2900U	3200UJ	3200UJ	2800UJ	2J	28J	10J
Methyl-t-butyl ether	--	--	--	24U	2900U	3200U	3200U	2800U	24U	120U	24U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: 3TFIRMB4	3TFIRMB4	AGTFSB1	AGTFSB1	AGTFSB2	AGTFSB3	AGTFSB3	AGTFSB4
	Impact to			Depth: 02	06	02	06	04	02	06	02
	Groundwater			Zone **: N3TF	N3TF	AGTF	AGTF	AGTF	AGTF	AGTF	AGTF
	Residential	Non-Residential	Groundwater	Date: 10/17/94	10/17/94	10/20/94	10/20/94	10/28/94	10/27/94	10/27/94	10/20/94
Methylene chloride	49000	210000	1000	13U	1400U	1600U	1600U	1400U	28U	130UJ	12U
n-Propylbenzene	--	--	--	24U	1200J	3200U	13000	2800U	24U	720	24U
Styrene	23000	97000	100000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Tetrachloroethene	4000	6000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Toluene	1000000	1000000	500000	12U	1400U	1600U	1600U	1400U	12U	9J	2J
Trichloroethene	23000	54000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Vinyl chloride	2000	7000	10000	12U	1400UJ	1600U	1600UJ	1400U	12U	61U	12U
Xylenes (Total)	410000	1000000	10000	12U	1400U	1600U	1600U	1400U	12U	78	2J
cis-1,3-Dichloropropene	4000	5000	1000	12U	1400U	1600UJ	1600U	1400U	12U	61U	12U
trans-1,3-Dichloropropene	4000	5000	1000	12U	1400U	1600U	1600U	1400U	12U	61U	12U
Total Volatile Organic Compounds				0	1390	0	293000	190	2	847	19

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: AHTFSB1	AHTFSB2	AHTFSB4	AHTFSB4	APSB2	APSB5	APSB5	APSB6
	Impact to			Depth: 02	02	02	08	02	02	08	08
	Groundwater			Zone **: AHTF	AHTF	AHTF	AHTF	AP	AP	AP	AP
	Residential	Non-Residential	Groundwater	Date: 10/19/94	10/14/94	10/14/94	10/14/94	10/26/94	10/12/94	10/12/94	10/21/94
1,1,1-Trichloroethane	210000	1000000	50000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1,1,2,2-Tetrachloroethane	34000	70000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1,1,2-Trichloroethane	22000	420000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1,1-Dichloroethane	570000	1000000	10000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1,1-Dichloroethene	8000	150000	10000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1,2-Dibromoethane	--	--	--	22U	2900U	2800U	2800U	23U	21U	3200U	22U
1,2-Dichloroethane	6000	24000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1,2-Dichloroethene(Total)	1079000	2000000	51000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1,2-Dichloropropane	10000	43000	--	11U	1400U	1300U	1400U	12U	11U	1500U	11U
1-Butanol	--	--	--	540UJ	72000U	69000U	70000UJ	580U	530UJ	80000U	580U
2-Butanol	--	--	--	540U	72000U	69000U	70000UJ	580U	530UJ	80000U	580U
2-Butanone	1000000	1000000	50000	8J	1400UJ	1300UJ	1400UJ	12UJ	11U	1500UJ	14J
2-Hexanone	--	--	--	11UJ	1400UJ	1300UJ	1400UJ	12U	11U	1500UJ	11U
2-Methyl-2-propanol	--	--	--	540U	72000U	69000U	70000UJ	580U	530UJ	80000U	580U
2-Propanol	--	--	--	540UJ	72000U	69000U	70000UJ	580UJ	530UJ	80000U	580UJ
4-Methyl-2-pentanone	1000000	1000000	50000	11UJ	1400U	1300U	1400U	12U	11U	1500U	11U
Acetone	1000000	1000000	100000	51UJ	1400UJ	1300UJ	1400UJ	13UJ	15U	1500UJ	60UJ
Benzene	3000	13000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	2J
Bromodichloromethane	11000	46000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Bromoform	86000	370000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Bromomethane	79000	1000000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Carbon disulfide	--	--	--	11U	1400UJ	1300UJ	1400UJ	12U	11U	1500UJ	11U
Carbon tetrachloride	2000	4000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Chlorobenzene	37000	680000	1000	11U	1400U	1300U	1400U	12U	11U	390J	11U
Chloroethane	--	--	--	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Chloroform	19000	28000	1000	11U	1400U	1300UJ	1400U	12U	11U	1500UJ	11U
Chloromethane	520000	1000000	10000	11UJ	1400U	1300U	1400U	12U	11U	1500U	11U
Dibromochloromethane	110000	1000000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Ethylbenzene	1000000	1000000	100000	4J	1400U	1300U	980J	12U	11U	1500U	9J
Hexane	--	--	--	22U	2900U	2800U	17000	23U	1J	3200U	22U
Methyl-t-butyl ether	--	--	--	22U	2900U	2800U	2800U	23U	21U	3200U	22U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: AHTFSB1	AHTFSB2	AHTFSB4	AHTFSB4	APSB2	APSB5	APSB5	APSB6
	Impact to			Depth: 02	02	02	08	02	02	06	08
	Groundwater			Zone **: AHTF	AHTF	AHTF	AHTF	AP	AP	AP	AP
	Residential	Non-Residential		Date: 10/19/94	10/14/94	10/14/94	10/14/94	10/26/94	10/12/94	10/12/94	10/21/94
Methylene chloride	49000	210000	1000	11UJ	1400U	1300U	1400U	23UJ	18U	2100U	19UJ
n-Propylbenzene	--	--	--	82	1300J	12000	7300	23U	21U	40000	6J
Styrene	23000	97000	100000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Tetrachloroethene	4000	6000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Toluene	1000000	1000000	500000	11U	1400U	1300U	1400U	12U	11U	300J	9J
Trichloroethene	23000	54000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Vinyl chloride	2000	7000	10000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
Xylenes (Total)	410000	1000000	10000	1J	1400U	1300U	610J	12U	11U	1500U	14
cis-1,3-Dichloropropene	4000	5000	1000	11U	1400U	1300U	1400U	12U	11U	1500U	11U
trans-1,3-Dichloropropene	4000	5000	1000	11U	1400U	1300U	1400U	12U	11UJ	1500U	11U
Total Volatile Organic Compounds				95	1300	12000	25890	0	1	40690	54

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: APSB6	DTSB3	DTSB3FR	ECIRMB1	ECIRMB3	ECIRMB3	ECPSB1	ECPSB2	ECPSB2
	Impact to			Depth: 10	04	04	02	02	06	02	06	12
	Groundwater			Zone **: AP	DT	DT	U	N3TF	N3TF	ECP	ECP	ECP
	Residential	Non-Residential	Groundwater	Date: 10/21/94	10/27/94	10/27/94	10/24/94	10/19/94	10/19/94	10/20/94	10/20/94	10/20/94
1,1,1-Trichloroethane	210000	1000000	50000	2800	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
1,1,2,2-Tetrachloroethane	34000	70000	1000	1600U	1500U	1500UJ	12U	11U	7900U	1400U	11U	58000U
1,1,2-Trichloroethane	22000	420000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
1,1-Dichloroethane	570000	1000000	10000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
1,1-Dichloroethene	8000	150000	10000	1600U	1500U	1500UJ	12U	11U	7900U	1400U	11U	58000U
1,2-Dibromoethane	--	--	--	3200U	3000U	3000U	23U	22U	16000U	2900U	23U	120000U
1,2-Dichloroethane	6000	24000	1000	1600U	1500UJ	1500U	12U	11U	7900U	1400U	11U	58000U
1,2-Dichloroethene(Total)	1079000	2000000	51000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
1,2-Dichloropropane	10000	43000	--	1600U	1500U	1500UJ	12U	11U	7900U	1400UJ	11U	58000UJ
1-Butanol	--	--	--	81000UJ	76000U	76000UJ	580UJ	560U	410000U	72000U	570UJ	2900000U
2-Butanol	--	--	--	81000UJ	76000U	76000U	580UJ	560U	410000U	72000U	570UJ	2900000U
2-Butanone	1000000	1000000	50000	1600UJ	1500UJ	1500UJ	12UJ	11UJ	7900UJ	1400UJ	11UJ	58000UJ
2-Hexanone	--	--	--	1600UJ	1500UJ	1500UJ	12U	11U	7900UJ	1400UJ	11U	58000UJ
2-Methyl-2-propanol	--	--	--	81000U	76000U	76000U	580UJ	560U	410000U	72000U	570UJ	2900000U
2-Propanol	--	--	--	81000UJ	76000U	76000U	580UJ	560UJ	410000U	72000U	570UJ	2900000U
4-Methyl-2-pentanone	1000000	1000000	50000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
Acetone	1000000	1000000	100000	1600UJ	1500UJ	1500UJ	20UJ	11UJ	7900UJ	1400UJ	38UJ	58000UJ
Benzene	3000	13000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	43	58000U
Bromodichloromethane	11000	46000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
Bromoform	86000	370000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
Bromomethane	79000	1000000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
Carbon disulfide	--	--	--	1600U	1500U	1500UJ	12U	11U	7900U	1400UJ	2J	58000UJ
Carbon tetrachloride	2000	4000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
Chlorobenzene	37000	680000	1000	6900	1500U	1500U	12U	11U	110000	280J	8100	<u>98000U</u>
Chloroethane	--	--	--	1600UJ	1500U	1500U	12U	11U	7900UJ	1400UJ	11U	58000UJ
Chloroform	19000	28000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
Chloromethane	520000	1000000	10000	1600UJ	1500U	1500U	12U	11U	7900UJ	1400UJ	11UJ	58000UJ
Dibromochloromethane	110000	1000000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	58000U
Ethylbenzene	1000000	1000000	100000	1600U	1500U	1500U	12U	11U	7900U	1400U	100	13000J
Hexane	--	--	--	3200UJ	3000U	3000U	2J	22U	16000UJ	2900U	10J	110000J
Methyl-t-butyl ether	--	--	--	3200U	3000U	3000U	23U	22U	16000U	2900U	23U	120000U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: APSB6	DTSB3	DTSB3FR	ECIRMB1	ECIRMB3	ECIRMB3	ECPSB1	ECPSB2	ECPSB2
	Impact to			Depth: 10	04	04	02	02	06	02	06	12
	Groundwater			Zone **: AP	DT	DT	U	N3TF	N3TF	ECP	ECP	ECP
	Residential	Non-Residential	Groundwater	Date: 10/21/94	10/27/94	10/27/94	10/24/94	10/19/94	10/19/94	10/20/94	10/20/94	10/20/94
Methylene chloride	49000	210000	1000	1600U	1500U	1500U	12UJ	11UJ	7900U	1400U	24UJ	56000U
n-Propylbenzene	--	--	--	6800	3000U	3000U	23U	22U	13000J	1100J	120	120000U
Styrene	23000	97000	100000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	56000U
Tetrachloroethene	4000	6000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	56000U
Toluene	1000000	1000000	500000	1600U	1500U	1500U	12U	11U	7900U	1400U	10J	11000J
Trichloroethene	23000	54000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	56000U
Vinyl chloride	2000	7000	10000	1600UJ	1500U	1500U	12U	11U	7900UJ	1400UJ	11UJ	56000UJ
Xylenes (Total)	410000	1000000	10000	1600U	1500U	1500U	12U	11U	1000J	1400U	120	48000J
cis-1,3-Dichloropropene	4000	5000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	56000U
trans-1,3-Dichloropropene	4000	5000	1000	1600U	1500U	1500U	12U	11U	7900U	1400U	11U	56000U
Total Volatile Organic Compounds				16500	0	0	2	0	124000	1380	8505	1162000

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: ECPSB4	ECPSB5	GFSB1	GTFIRMB1	GTFIRMB2	GTFIRMB3	GTFIRMB4
	Impact to			Depth: 08	02	02	02	02	02	02
	Groundwater			Zone **: ECP	ECP	STF	GTF	GTF	GTF	GTF
	Residential	Non-Residential		Date: 10/19/94	10/19/94	10/12/94	10/06/94	10/17/94	10/05/94	10/17/94
1,1,1-Trichloroethane	210000	1000000	50000	12U	17U	1400U	11U	11U	11U	12U
1,1,2,2-Tetrachloroethane	34000	70000	1000	12U	17U	1400U	11U	11U	11U	12U
1,1,2-Trichloroethane	22000	420000	1000	12U	17U	1400U	11U	11U	11U	12U
1,1-Dichloroethane	570000	1000000	10000	12U	17U	1400U	11U	11U	11U	12U
1,1-Dichloroethane	8000	150000	10000	12U	17U	1400U	11U	11U	11U	12U
1,2-Dibromoethane	--	--	--	24U	33U	2800U	22U	23U	22U	24U
1,2-Dichloroethane	6000	24000	1000	12U	17U	1400U	11U	11U	11U	12U
1,2-Dichloroethane(Total)	1079000	2000000	51000	12U	17U	1400U	11U	11U	11U	12U
1,2-Dichloropropane	10000	43000	--	12U	17U	1400U	11U	11U	11U	12U
1-Butanol	--	--	--	600U	830U	71000U	560UJ	570UJ	550UJ	600U
2-Butanol	--	--	--	600U	830U	71000U	560UJ	570UJ	550UJ	600U
2-Butanone	1000000	1000000	50000	12UJ	17UJ	1400UJ	11U	11UJ	11U	2J
2-Hexanone	--	--	--	12U	17U	1400UJ	11U	11U	11U	12U
2-Methyl-2-propanol	--	--	--	600U	830U	71000U	560UJ	570UJ	550UJ	600U
2-Propanol	--	--	--	600UJ	830UJ	71000U	560UJ	570UJ	550UJ	600UJ
4-Methyl-2-pentanone	1000000	1000000	50000	12U	17U	1400U	7J	11U	11U	12U
Acetone	1000000	1000000	100000	19UJ	36UJ	1400UJ	33U	13U	13U	13U
Benzene	3000	13000	1000	11J	4J	1400U	11U	11U	11U	12U
Bromodichloromethane	11000	46000	1000	12U	17U	1400U	11U	11U	11U	12U
Bromoform	86000	370000	1000	12U	17U	1400U	11U	11U	11U	12U
Bromomethane	79000	1000000	1000	12U	17U	1400U	11U	11U	11U	12U
Carbon disulfide	--	--	--	12U	17U	1400U	11U	11U	11U	12U
Carbon tetrachloride	2000	4000	1000	12U	17U	1400UJ	11U	11U	11U	12U
Chlorobenzene	37000	680000	1000	6J	330	1400U	11U	11U	11U	12U
Chloroethane	--	--	--	12U	17U	1400U	11U	11U	11U	12U
Chloroform	19000	28000	1000	12U	17U	1400U	11U	11U	11U	12U
Chloromethane	520000	1000000	10000	12U	17U	1400UJ	11U	11UJ	11U	12U
Dibromochloromethane	110000	1000000	1000	12U	17U	1400U	11U	11U	11U	12U
Ethylbenzene	1000000	1000000	100000	4J	17U	1400U	11U	11U	11U	12U
Hexane	--	--	--	78	4J	2800UJ	1J	2J	3J	1J
Methyl-t-butyl ether	--	--	--	24U	33U	2800U	22U	23U	22U	24U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: ECPSB4	ECPSB5	GFSB1	GTFIRMB1	GTFIRMB2	GTFIRMB3	GTFIRMB4
	Impact to			Depth: 08	02	02	02	02	02	02
	Groundwater			Zone **: ECP	ECP	STF	GTF	GTF	GTF	GTF
	Residential	Non-Residential		Date: 10/19/94	10/19/94	10/12/94	10/06/94	10/17/94	10/05/94	10/17/94
Methylene chloride	49000	210000	1000	21UJ	33UJ	1400U	27U	18U	27U	15U
n-Propylbenzene	--	--	--	4J	14J	1400J	22U	23U	22U	24U
Styrene	23000	97000	100000	12U	17U	1400U	11U	11U	11U	12U
Tetrachloroethene	4000	8000	1000	12U	17U	1400U	11U	11U	11U	12U
Toluene	1000000	1000000	500000	3J	17U	250J	1J	11U	11U	12U
Trichloroethene	23000	54000	1000	12U	17U	1400U	11U	11U	11U	12U
Vinyl chloride	2000	7000	10000	12U	17U	1400U	11U	11U	11U	12U
Xylenes (Total)	410000	1000000	10000	6J	17U	280J	11U	11U	11U	12U
cis-1,3-Dichloropropene	4000	5000	1000	12UJ	17U	1400U	11U	11U	11U	12U
trans-1,3-Dichloropropene	4000	5000	1000	12U	17U	1400U	11UJ	11U	11UJ	12U
Total Volatile Organic Compounds				112	352	1930	9	2	3	3

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB5	GTFIRMB5FR	GTFIRMB5	GTFIRMB6	GTFIRMB7	GTFIRMB8	GTFIRMB8
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	06	04	02	02	08
				Zone **: GTF	GTF	GTF	GTF	GTF	GTF	GTF
				Date: 10/05/94	10/05/94	10/05/94	10/05/94	10/17/94	10/18/94	10/18/94
1,1,1-Trichloroethane	210000	1000000	50000	12U	13U	13U	15U	11U	11U	13U
1,1,2,2-Tetrachloroethane	34000	70000	1000	12U	13U	13U	15U	11U	11U	13U
1,1,2-Trichloroethane	22000	420000	1000	12U	13U	13U	15U	11U	11U	13U
1,1-Dichloroethane	570000	1000000	10000	12U	13U	13U	15U	11U	11U	13U
1,1-Dichloroethane	8000	150000	10000	12U	13U	13U	15U	11U	11U	13U
1,2-Dibromoethane	--	--	--	25U	25U	26U	29U	23U	23U	26U
1,2-Dichloroethane	6000	24000	1000	12U	13U	13U	15U	11U	11U	13U
1,2-Dichloroethane(Total)	1079000	2000000	51000	12U	13U	13U	15U	11U	11U	13U
1,2-Dichloropropane	10000	43000	--	12U	13U	13U	15U	11U	11U	13U
1-Butanol	--	--	--	620U	630U	660UJ	740U	570U	570UJ	650U
2-Butanol	--	--	--	620UJ	630UJ	660UJ	740UJ	570U	570U	650U
2-Butanone	1000000	1000000	50000	42J	14J	55	12J	11UJ	11UJ	13UJ
2-Hexanone	--	--	--	12UJ	13UJ	13U	15UJ	11U	11UJ	13U
2-Methyl-2-propanol	--	--	--	620U	630U	660UJ	740U	570U	570U	650U
2-Propanol	--	--	--	620U	630U	660UJ	740U	570UJ	570UJ	650UJ
4-Methyl-2-pentanone	1000000	1000000	50000	10J	13U	160	15U	11U	11UJ	13U
Acetone	1000000	1000000	100000	170	49U	160	58U	11U	18UJ	150UJ
Benzene	3000	13000	1000	12U	13U	6J	12J	11U	11U	13U
Bromodichloromethane	11000	46000	1000	12U	13U	13U	15U	11U	11U	13U
Bromoform	86000	370000	1000	12U	13U	13U	15U	11U	11U	13U
Bromomethane	79000	1000000	1000	12U	13U	13U	15U	11U	11U	13U
Carbon disulfide	--	--	--	12U	13U	13U	15U	11U	11U	13U
Carbon tetrachloride	2000	4000	1000	12U	13U	13U	15U	11U	11U	13U
Chlorobenzene	37000	680000	1000	12U	13U	13U	3J	11U	11U	40
Chloroethane	--	--	--	12U	13U	13U	15U	11U	11U	13U
Chloroform	19000	28000	1000	12U	13U	13U	15U	11U	43	13U
Chloromethane	520000	1000000	10000	12UJ	13UJ	13U	15UJ	11U	11UJ	13U
Dibromochloromethane	110000	1000000	1000	12U	13U	13U	15U	11U	11U	13U
Ethylbenzene	1000000	1000000	100000	12U	13U	12J	35	11U	11U	13U
Hexane	--	--	--	2J	1J	9J	3J	2J	2J	4J
Methyl-t-butyl ether	--	--	--	25U	25U	26U	29UJ	23U	23U	26U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB5	GTFIRMB5FR	GTFIRMB5	GTFIRMB6	GTFIRMB7	GTFIRMB8	GTFIRMB8
	Impact to			Depth: 02	02	06	04	02	02	08
	Groundwater			Zone **: GTF	GTF	GTF	GTF	GTF	GTF	GTF
	Residential	Non-Residential	Groundwater	Date: 10/05/94	10/05/94	10/05/94	10/05/94	10/17/94	10/18/94	10/18/94
Methylene chloride	49000	210000	1000	29U	13U	25U	32U	19U	25UJ	43UJ
n-Propylbenzene	--	--	--	2J	25U	7J	44	23U	23U	18J
Styrene	23000	97000	100000	12U	13U	13U	15U	11U	11U	13U
Tetrachloroethene	4000	6000	1000	12U	13U	13U	3J	11U	11U	13U
Toluene	1000000	1000000	500000	9J	3J	62	20	11U	11U	13U
Trichloroethene	23000	54000	1000	12U	13U	13U	15U	11U	11U	13U
Vinyl chloride	2000	7000	10000	12U	13U	13U	15U	11U	11U	13U
Xylenes (Total)	410000	1000000	10000	10J	5J	45	42	11U	11U	12J
cis-1,3-Dichloropropene	4000	5000	1000	12U	13U	13U	15U	11U	11U	13UJ
trans-1,3-Dichloropropene	4000	5000	1000	12UJ	13UJ	13UJ	15UJ	11U	11U	13U
Total Volatile Organic Compounds				245	23	516	174	2	45	74

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB9	GTFSB1	GTFSB1	GTFSB2	GTFSB3	GTFSB4	GTFSB5	GTFSB6	GTFSB7
	Depth: 02			Depth: 02	02	08	02	02	02	02	02	02
	Impact to			Zone **: GTF	GTF	GTF	GTF	GTF	GTF	GTF	GTF	GTF
	Residential	Non-Residential	Groundwater	Date: 10/05/94	10/10/94	10/10/94	10/13/94	10/10/94	10/13/94	10/13/94	10/11/94	10/13/94
1,1,1-Trichloroethane	210000	1000000	50000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
1,1,2,2-Tetrachloroethane	34000	70000	1000	12U	12U	1700U	12U	12UJ	11U	11U	11U	11U
1,1,2-Trichloroethane	22000	420000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
1,1-Dichloroethane	570000	1000000	10000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
1,1-Dichloroethene	8000	150000	10000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
1,2-Dibromoethane	--	--	--	25U	24U	3600U	25U	24U	22U	22U	23U	23U
1,2-Dichloroethane	6000	24000	1000	12U	12U	1700UJ	12U	12U	11U	11U	11U	11U
1,2-Dichloroethene(Total)	1079000	2000000	51000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
1,2-Dichloropropane	10000	43000	--	12U	12U	1700U	12U	12U	11U	11U	11U	11U
1-Butanol	--	--	--	620U	600UJ	91000U	620UJ	590UJ	560UJ	540UJ	570U	570UJ
2-Butanol	--	--	--	620UJ	600UJ	91000U	620UJ	590U	560U	540U	570UJ	570U
2-Butanone	1000000	1000000	50000	12UJ	12U	1700UJ	11J	12U	11UJ	11UJ	11UJ	11UJ
2-Hexanone	--	--	--	12UJ	12U	1700UJ	12U	12U	11U	11U	11UJ	11U
2-Methyl-2-propanol	--	--	--	620U	600UJ	91000U	620UJ	590U	560UJ	540UJ	570U	570UJ
2-Propanol	--	--	--	620U	600UJ	91000U	620UJ	590U	560UJ	540UJ	570U	570UJ
4-Methyl-2-pentanone	1000000	1000000	50000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Acetone	1000000	1000000	100000	18U	17U	1700UJ	66U	20U	27U	18U	16U	27U
Benzene	3000	13000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Bromodichloromethane	11000	46000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Bromoform	86000	370000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Bromomethane	79000	1000000	1000	12U	12U	1700U	12U	12U	11UJ	11UJ	11U	11UJ
Carbon disulfide	--	--	--	12U	12U	1700UJ	12U	12U	11U	11U	11U	11U
Carbon tetrachloride	2000	4000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Chlorobenzene	37000	680000	1000	12U	12U	1700U	2J	12U	11U	11U	11U	11U
Chloroethane	--	--	--	12U	12U	1700U	12U	12U	11UJ	11UJ	11U	11UJ
Chloroform	19000	28000	1000	12U	12U	1700UJ	12U	12U	11U	11U	11U	11U
Chloromethane	520000	1000000	10000	12UJ	12U	1700U	12UJ	12U	11UJ	11UJ	11UJ	11UJ
Dibromochloromethane	110000	1000000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Ethylbenzene	1000000	1000000	100000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Hexane	--	--	--	2J	24U	3600U	25U	1J	2J	22U	23U	23U
Methyl-t-butyl ether	--	--	--	25U	24U	3600U	25U	24U	22U	22U	23U	23U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB9	GTFSB1	GTFSB1	GTFSB2	GTFSB3	GTFSB4	GTFSB5	GTFSB6	GTFSB7
	Impact to			Depth: 02	02	08	02	02	02	02	02	02
	Groundwater			Zone **: GTF	GTF	GTF	GTF	GTF	GTF	GTF	GTF	GTF
	Residential	Non-Residential	Groundwater	Date: 10/05/94	10/10/94	10/10/94	10/13/94	10/10/94	10/13/94	10/13/94	10/11/94	10/13/94
Methylene chloride	49000	210000	1000	12U	33U	2700U	32U	63U	23U	22U	46U	23U
n-Propylbenzene	--	--	--	25U	24U	3600U	25U	24U	22U	22U	23U	23U
Styrene	23000	97000	100000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Tetrachloroethene	4000	6000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Toluene	1000000	1000000	500000	12U	12U	3900	12U	12U	11U	11U	11U	11U
Trichloroethene	23000	54000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
Vinyl chloride	2000	7000	10000	12U	12U	1700U	12U	12U	11UJ	11UJ	11U	11UJ
Xylenes (Total)	410000	1000000	10000	12U	12U	310J	12UJ	12U	11U	11U	11U	11U
cis-1,3-Dichloropropene	4000	5000	1000	12U	12U	1700U	12U	12U	11U	11U	11U	11U
trans-1,3-Dichloropropene	4000	5000	1000	12UJ	12UJ	1700U	12U	12UJ	11U	11U	11UJ	11U
Total Volatile Organic Compounds				2	0	4210	13	1	2	0	0	0

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB7	GTFSB8	GTFSB8	GTFSB9	GTFSB9	LAIRMB1	LOSB1	LOSB1	LOSB2
				Depth: 08	04	08	02	08	02	04	08	04
	Impact to			Zone** : GTF	GTF	GTF	GTF	GTF	LO	LO	LO	LO
	Residential	Non-Residential	Groundwater	Date: 10/13/94	10/13/94	10/13/94	10/13/94	10/13/94	10/24/94	10/25/94	10/25/94	10/14/94
1,1,1-Trichloroethane	210000	1000000	50000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1,1,2,2-Tetrachloroethane	34000	70000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1,1,2-Trichloroethane	22000	420000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1,1-Dichloroethane	570000	1000000	10000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1,1-Dichloroethene	8000	150000	10000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1,2-Dibromoethane	--	--	--	3400U	23U	27UJ	22U	2900U	27U	23U	2900U	28U
1,2-Dichloroethane	6000	24000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1,2-Dichloroethane(Total)	1079000	2000000	51000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1,2-Dichloropropane	10000	43000	--	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
1-Butanol	--	--	--	86000U	570UJ	680UJ	540UJ	73000U	670UJ	580U	72000U	700UJ
2-Butanol	--	--	--	86000U	570UJ	680UJ	540UJ	73000U	670UJ	580U	72000U	700UJ
2-Butanone	1000000	1000000	50000	1600UJ	10J	14UJ	4J	1400UJ	8J	12UJ	1400UJ	19J
2-Hexanone	--	--	--	1800UJ	11U	14UJ	11UJ	1400UJ	13U	12U	1400UJ	14U
2-Methyl-2-propanol	--	--	--	86000U	570UJ	680UJ	540UJ	73000U	670UJ	580U	72000U	700UJ
2-Propanol	--	--	--	86000U	570UJ	680UJ	540UJ	73000U	670UJ	580UJ	72000U	700UJ
4-Methyl-2-pentanone	1000000	1000000	50000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Acetone	1000000	1000000	100000	1600UJ	47U	23UJ	26UJ	1400UJ	37UJ	31UJ	1400UJ	71U
Benzene	3000	13000	1000	1600U	11U	1J	11U	420J	13U	12U	1400U	14U
Bromodichloromethane	11000	46000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Bromoform	86000	370000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Bromomethane	79000	1000000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Carbon disulfide	--	--	--	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	11J
Carbon tetrachloride	2000	4000	1000	1600UJ	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Chlorobenzene	37000	680000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Chloroethane	--	--	--	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Chloroform	19000	28000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Chloromethane	520000	1000000	10000	1600UJ	11UJ	14UJ	11UJ	1400U	13U	12U	1400U	14U
Dibromochloromethane	110000	1000000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Ethylbenzene	1000000	1000000	100000	1600U	11U	14UJ	11U	6600	13U	4J	650J	4J
Hexane	--	--	--	3400UJ	2J	8J	3J	2900U	27U	5J	2900U	6J
Methyl-t-butyl ether	--	--	--	3400U	23U	27UJ	22U	2900U	27U	23U	2900U	28U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB7	GTFSB8	GTFSB8	GTFSB9	GTFSB9	LAIRMB1	LOSB1	LOSB1	LOSB2
				Depth: 08	04	08	02	08	02	04	08	04
	Impact to			Zone**; GTF	GTF	GTF	GTF	GTF	LO	LO	LO	LO
	Residential	Non-Residential	Groundwater	Date: 10/13/94	10/13/94	10/13/94	10/13/94	10/13/94	10/24/94	10/25/94	10/25/94	10/14/94
Methylene chloride	49000	210000	1000	1600U	31U	20UJ	42U	1400U	25UJ	12UJ	1400U	32U
n-Propylbenzene	--	--	--	3000J	1J	35J	22U	13000	27U	60	1300J	28U
Styrene	23000	97000	100000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Tetrachloroethene	4000	6000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Toluene	1000000	1000000	500000	1600U	3J	2J	2J	230J	13U	12U	270J	2J
Trichloroethene	23000	54000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Vinyl chloride	2000	7000	10000	1600U	11U	14UJ	11UJ	1400U	13U	12U	1400U	14U
Xylenes (Total)	410000	1000000	10000	1600U	7J	9J	4J	26000	13U	93	3000	24
cis-1,3-Dichloropropene	4000	5000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14UJ
trans-1,3-Dichloropropene	4000	5000	1000	1600U	11U	14UJ	11U	1400U	13U	12U	1400U	14U
Total Volatile Organic Compounds				3000	23	55	13	46250	8	162	5220	66

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB2	LOSB3	LOSB4	LOSB4	LOSB8	LOSB8	LOSB9	LOSB9
				Depth: 08	02	02	06	02	08	02	06
	Impact to			Zone**: LO	LO	LO	LO	SS	SS	LO	LO
	Residential	Non-Residential	Groundwater	Date: 10/14/94	10/24/94	10/24/94	10/24/94	10/24/94	10/24/94	10/25/94	10/25/94
1,1,1-Trichloroethane	210000	1000000	50000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1,1,2,2-Tetrachloroethane	34000	70000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1,1,2-Trichloroethane	22000	420000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1,1-Dichloroethane	570000	1000000	10000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1,1-Dichloroethene	8000	150000	10000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1,2-Dibromoethane	--	--	--	4600U	25U	110U	2700UJ	120U	23U	26U	22U
1,2-Dichloroethane	8000	24000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1,2-Dichloroethene(Total)	1079000	2000000	51000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1,2-Dichloropropane	10000	43000	--	2200U	12U	53U	1300UJ	58U	12U	13U	11U
1-Butanol	--	--	--	120000U	620UJ	2700UJ	86000UJ	2900UJ	580U	640UJ	560UJ
2-Butanol	--	--	--	120000U	620UJ	2700UJ	86000UJ	2900UJ	580U	640UJ	560UJ
2-Butanone	1000000	1000000	50000	2200UJ	12UJ	53UJ	1300UJ	82J	12UJ	13UJ	25J
2-Hexanone	--	--	--	2200UJ	12U	53U	1300UJ	58U	12U	13U	11U
2-Methyl-2-propanol	--	--	--	120000U	620UJ	2700UJ	86000UJ	2900UJ	580U	640UJ	560UJ
2-Propanol	--	--	--	120000U	620UJ	2700UJ	86000UJ	2900UJ	580UJ	640UJ	560UJ
4-Methyl-2-pentanone	1000000	1000000	50000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Acetone	1000000	1000000	100000	2200UJ	21UJ	87UJ	1300UJ	230UJ	19UJ	13UJ	80UJ
Benzene	3000	13000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Bromodichloromethane	11000	46000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Bromoform	86000	370000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Bromomethane	79000	1000000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Carbon disulfide	--	--	--	2200UJ	12U	53U	1300UJ	58U	12U	13U	11U
Carbon tetrachloride	2000	4000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Chlorobenzene	37000	680000	1000	2200U	12U	53U	1300UJ	58U	2J	13U	11U
Chloroethane	--	--	--	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Chloroform	19000	28000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Chloromethane	520000	1000000	10000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Dibromochloromethane	110000	1000000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Ethylbenzene	1000000	1000000	100000	290J	12U	53U	200J	58U	12U	13U	3J
Hexane	--	--	--	4500J	1J	14J	2700UJ	19J	8J	26U	15J
Methyl-t-butyl ether	--	--	--	4600U	25U	110U	2700UJ	120U	23U	26U	22U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB2	LOSB3	LOSB4	LOSB4	LOSB8	LOSB8	LOSB9	LOSB9
	Impact to			Depth: 08	02	02	06	02	08	02	06
	Zone **: LO			LO	LO	LO	LO	SS	SS	LO	LO
	Residential	Non-Residential	Groundwater	Date: 10/14/94	10/24/94	10/24/94	10/24/94	10/24/94	10/24/94	10/25/94	10/25/94
Methylene chloride	49000	210000	1000	2200U	17UJ	140UJ	1300UJ	91UJ	17UJ	39UJ	32UJ
n-Propylbenzene	--	--	--	4600U	25U	110U	3600J	200	110	264	30
Styrene	23000	97000	100000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Tetrachloroethene	4000	6000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	1J
Toluene	1000000	1000000	500000	260J	12U	53U	1300UJ	58U	12U	13U	2J
Trichloroethene	23000	54000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Vinyl chloride	2000	7000	10000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Xylenes (Total)	410000	1000000	10000	1600J	12U	53U	4700J	24J	8J	13U	24
cis-1,3-Dichloropropene	4000	5000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
trans-1,3-Dichloropropene	4000	5000	1000	2200U	12U	53U	1300UJ	58U	12U	13U	11U
Total Volatile Organic Compounds				6650	1	14	8500	325	128	0	100

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB10	LOSB10	LOSB11	LOSB12	LOSB12	LOSB13	LOSB13FR
	Impact to			Depth: 04	08	02	02	08	02	02
	Groundwater			Zone*: LO	LO	LO	LO	LO	LO	LO
	Residential	Non-Residential	Groundwater	Date: 10/28/94	10/28/94	10/25/94	10/25/94	10/25/94	10/31/94	10/31/94
1,1,1-Trichloroethane	210000	1000000	50000	1300U	1400U	13U	14U	1500U	1400U	1400U
1,1,2,2-Tetrachloroethane	34000	70000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
1,1,2-Trichloroethane	22000	420000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
1,1-Dichloroethane	570000	1000000	10000	1300U	1400U	13U	14U	1500U	1400U	1400U
1,1-Dichloroethene	8000	150000	10000	1300U	1400UJ	13U	14U	1500U	1400U	1400U
1,2-Dibromoethane	--	--	--	2800U	2900U	27U	28U	3100U	2900U	2900U
1,2-Dichloroethane	6000	24000	1000	1300U	1400U	13U	14U	1500U	1400UJ	1400UJ
1,2-Dichloroethene(Total)	1079000	2000000	51000	1300U	1400U	13U	14U	1500U	1400U	1400U
1,2-Dichloropropane	10000	43000	--	1300U	1400UJ	13U	14U	1500UJ	1400U	1400U
1-Butanol	--	--	--	70000UJ	73000UJ	670UJ	700UJ	77000U	72000U	72000U
2-Butanol	--	--	--	70000U	73000U	670UJ	700UJ	77000U	72000U	72000U
2-Butanone	1000000	1000000	50000	1300UJ	1400UJ	13UJ	14UJ	1500UJ	1400UJ	1400UJ
2-Hexanone	--	--	--	1300UJ	1400UJ	13U	14U	1500UJ	1400UJ	1400UJ
2-Methyl-2-propanol	--	--	--	70000U	73000UJ	670UJ	700UJ	77000U	72000U	72000U
2-Propanol	--	--	--	70000U	73000U	670U	700UJ	77000U	72000U	72000U
4-Methyl-2-pentanone	1000000	1000000	50000	1300U	1400U	13U	14U	1500U	1400U	1400U
Acetone	1000000	1000000	100000	2500UJ	1400UJ	13UJ	14UJ	1500UJ	1400UJ	1400UJ
Benzene	3000	13000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Bromodichloromethane	11000	46000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Bromoform	86000	370000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Bromomethane	79000	1000000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Carbon disulfide	--	--	--	1300U	1400UJ	13U	14U	1500UJ	1400U	1400U
Carbon tetrachloride	2000	4000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Chlorobenzene	37000	680000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Chloroethane	--	--	--	1300U	1400U	13U	14U	1500UJ	1400U	1400U
Chloroform	19000	28000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Chloromethane	520000	1000000	10000	1300U	1400UJ	13U	14U	1500UJ	1400U	1400U
Dibromochloromethane	110000	1000000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Ethylbenzene	1000000	1000000	100000	150J	1400U	13U	14U	1500U	1400U	1400U
Hexane	--	--	--	260J	2900UJ	27U	28U	3100U	2900U	2900U
Methyl-t-butyl ether	--	--	--	2800U	2900U	27U	28U	3100U	2900U	2900U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB10	LOSB10	LOSB11	LOSB12	LOSB12	LOSB13	LOSB13FR
				Depth: 04	08	02	02	06	02	02
				Zone **: LO	LO	LO	LO	LO	LO	LO
	Residential	Non-Residential	Impact to Groundwater	Date: 10/28/94	10/28/94	10/25/94	10/25/94	10/25/94	10/31/94	10/31/94
Methylene chloride	49000	210000	1000	1300U	1400U	16U	24UJ	1500U	1400U	1400U
n-Propylbenzene	--	--	--	2800U	6800	4J	28U	3100U	2900U	2900U
Styrene	23000	97000	100000	1300U	1400U	13U	14U	1500U	1400U	1400U
Tetrachloroethene	4000	8000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Toluene	1000000	1000000	500000	1300U	1400U	13U	14U	1500U	1400U	1400U
Trichloroethene	23000	54000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Vinyl chloride	2000	7000	10000	1300U	1400U	13U	14U	1500UJ	1400U	1400U
Xylenes (Total)	410000	1000000	10000	390J	1400U	13U	14U	1500U	1400U	1400U
cis-1,3-Dichloropropene	4000	5000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
trans-1,3-Dichloropropene	4000	5000	1000	1300U	1400U	13U	14U	1500U	1400U	1400U
Total Volatile Organic Compounds				800	6800	4	0	0	0	0

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB13	LOSB14	LOSB15	LOSB16	LOSB17	LOSB18	LOSB18	LOSB18FR
				Depth: 08	02	02	04	02	02	08	08
				Zone **: LO	LO	LO	LO	LO	LO	LO	LO
	Impact to			Date: 10/31/94	10/25/94	10/24/94	10/25/94	10/24/94	10/24/94	10/24/94	10/24/94
	Residential	Non-Residential	Groundwater								
1,1,1-Trichloroethane	210000	1000000	50000	56U	14U	12U	2700U	12U	11U	13U	13U
1,1,2,2-Tetrachloroethane	34000	70000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
1,1,2-Trichloroethane	22000	420000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
1,1-Dichloroethane	570000	1000000	10000	56U	14U	12U	2700U	12U	11U	13U	13U
1,1-Dichloroethane	8000	150000	10000	56U	14U	12U	2700U	12U	11UJ	13U	13U
1,2-Dibromoethane	--	--	--	110U	27U	23U	5600U	24U	23U	27U	26U
1,2-Dichloroethane	6000	24000	1000	56U	14U	12U	2700UJ	12U	11U	13U	13U
1,2-Dichloroethane(Total)	1079000	2000000	51000	56U	14U	12U	2700U	12U	11U	13U	13U
1,2-Dichloropropane	10000	43000	--	56U	14U	12U	2700U	12U	11U	13U	13U
1-Butanol	--	--	--	2800U	1700J	580UJ	140000U	600UJ	570UJ	670U	650U
2-Butanol	--	--	--	2800U	680UJ	580UJ	140000U	600UJ	570UJ	670U	650U
2-Butanone	1000000	1000000	50000	56UJ	14UJ	5J	2700UJ	3J	11UJ	10J	14J
2-Hexanone	--	--	--	56U	31	12U	2700UJ	12U	11U	13U	13U
2-Methyl-2-propanol	--	--	--	2800U	680UJ	580UJ	140000U	600UJ	570UJ	670U	650U
2-Propanol	--	--	--	2800UJ	680UJ	580UJ	140000U	600UJ	570UJ	670UJ	650UJ
4-Methyl-2-pentanone	1000000	1000000	50000	56U	26	12U	2700U	12U	11U	13U	13U
Acetone	1000000	1000000	100000	170UJ	20UJ	34UJ	2700UJ	22UJ	16UJ	43UJ	51UJ
Benzene	3000	13000	1000	56U	14U	12U	2700U	12U	11UJ	13U	13U
Bromodichloromethane	11000	46000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
Bromoform	86000	370000	1000	56UJ	14U	12U	2700U	12U	11U	13U	13U
Bromomethane	79000	1000000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
Carbon disulfide	--	--	--	56U	14U	12U	2700U	12U	11U	13U	13U
Carbon tetrachloride	2000	4000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
Chlorobenzene	37000	680000	1000	56U	14U	12U	2700U	12U	11UJ	13U	13U
Chloroethane	--	--	--	56U	14U	12U	2700U	12U	11U	13U	13U
Chloroform	19000	28000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
Chloromethane	520000	1000000	10000	56U	14U	12U	2700U	12U	11U	13U	13U
Dibromochloromethane	110000	1000000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
Ethylbenzene	1000000	1000000	100000	9J	14U	12U	2700U	12U	11U	13U	13U
Hexane	--	--	--	21J	27U	1J	5600U	1J	1J	6J	3J
Methyl-t-butyl ether	--	--	--	110U	27U	23U	5600U	24U	23U	27U	26U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB13	LOSB14	LOSB15	LOSB16	LOSB17	LOSB18	LOSB18	LOSB18FR
	Residential	Non-Residential	Impact to Groundwater	Depth: 08	02	02	04	02	02	08	08
				Zone **: LO	LO	LO	LO	LO	LO	LO	LO
				Date: 10/31/94	10/25/94	10/24/94	10/25/94	10/24/94	10/24/94	10/24/94	10/24/94
Methylene chloride	49000	210000	1000	74UJ	40UJ	16UJ	2700U	15UJ	15UJ	61UJ	18UJ
n-Propylbenzene	--	--	--	86J	27U	23U	5600U	24U	23U	27U	26U
Styrene	23000	97000	100000	56U	14U	12U	2700U	12U	11U	13U	13U
Tetrachloroethene	4000	6000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
Toluene	1000000	1000000	500000	56U	14U	12U	2700U	12U	11UJ	13U	13U
Trichloroethene	23000	54000	1000	56U	14U	12U	2700U	12U	11UJ	13U	13U
Vinyl chloride	2000	7000	10000	56U	14U	12U	2700U	12U	11U	13U	13U
Xylenes (Total)	410000	1000000	10000	13J	14U	12U	2700U	12U	11U	13U	2J
cis-1,3-Dichloropropene	4000	5000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
trans-1,3-Dichloropropene	4000	5000	1000	56U	14U	12U	2700U	12U	11U	13U	13U
Total Volatile Organic Compounds				129	1757	6	0	4	1	16	19

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: MBSB1	MBSB2	MBSB3	MBSB3	MBSB3FR	MDCSB2-03	N2TFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	06	10	10	03	02
				Zone **: MB	MB	MB	MB	MB	MDC	N2TF
				Date: 10/25/94	10/21/94	10/25/94	10/25/94	10/25/94	10/11/94	10/19/94
1,1,1-Trichloroethane	210000	1000000	50000	11U	12U	15U	1700U	1700U	11U	12U
1,1,2,2-Tetrachloroethane	34000	70000	1000	11U	12U	15U	1700U	1700U	11U	12U
1,1,2-Trichloroethane	22000	420000	1000	11U	12U	15U	1700U	1700U	11U	12U
1,1-Dichloroethane	570000	1000000	10000	11U	12U	15U	1700U	1700U	11U	12U
1,1-Dichloroethene	8000	150000	10000	11U	12U	15U	1700U	1700U	11U	12U
1,2-Dibromoethane	--	--	--	23U	23U	29U	3400U	3300U	22U	25U
1,2-Dichloroethane	8000	24000	1000	11U	12U	15U	1700U	1700U	11U	12U
1,2-Dichloroethene(Total)	1079000	2000000	51000	11U	12U	15U	1700U	1700U	11U	12U
1,2-Dichloropropane	10000	43000	--	11U	12U	15U	1700UJ	1700UJ	11U	12U
1-Butanol	--	--	--	570UJ	580U	740UJ	86000U	83000U	540UJ	620U
2-Butanol	--	--	--	570UJ	580U	740UJ	86000U	83000U	540U	620U
2-Butanone	1000000	1000000	50000	11UJ	12UJ	15UJ	1700UJ	1700UJ	11UJ	12UJ
2-Hexanone	--	--	--	11U	12U	15UJ	1700U	1700UJ	11U	12U
2-Methyl-2-propanol	--	--	--	570UJ	580U	740UJ	86000U	83000U	540UJ	620U
2-Propanol	--	--	--	570UJ	580UJ	740UJ	86000U	83000U	540UJ	620UJ
4-Methyl-2-pentanone	1000000	1000000	50000	11U	12U	15U	1700U	1700U	11U	12U
Acetone	1000000	1000000	100000	61UJ	34UJ	15UJ	1700UJ	1700UJ	14U	22UJ
Benzene	3000	13000	1000	5J	12U	15U	1700U	1700U	11U	12U
Bromodichloromethane	11000	46000	1000	11U	12U	15U	1700U	1700U	11U	12U
Bromoform	86000	370000	1000	11U	12U	15U	1700U	1700U	11U	12U
Bromomethane	79000	1000000	1000	11U	12U	15U	1700U	1700U	11UJ	12U
Carbon disulfide	--	--	--	4J	12U	15U	1700UJ	1700UJ	11U	12U
Carbon tetrachloride	2000	4000	1000	11U	12U	15U	1700U	1700U	11U	12U
Chlorobenzene	37000	680000	1000	7J	12U	15U	530J	460J	11U	12U
Chloroethane	--	--	--	11U	12U	15U	1700UJ	1700UJ	11UJ	12U
Chloroform	19000	28000	1000	11U	12U	15U	1700U	1700U	11U	12U
Chloromethane	520000	1000000	10000	11U	12U	15U	1700UJ	1700UJ	11UJ	12U
Dibromochloromethane	110000	1000000	1000	11U	12U	15U	1700U	1700U	11U	12U
Ethylbenzene	1000000	1000000	100000	3J	8J	15U	1700U	1700U	1J	12U
Hexane	--	--	--	14J	3J	29U	3400U	3300U	1J	5J
Methyl-t-butyl ether	--	--	--	23U	23U	29U	3400U	3300U	22U	25U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: MBSB1	MBSB2	MBSB3	MBSB3	MBSB3FR	MDCSB2-03	N2TFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	06	10	10	03	02
				Zone **: MB	MB	MB	MB	MB	MDC	N2TF
				Date: 10/25/94	10/21/94	10/25/94	10/25/94	10/25/94	10/11/94	10/19/94
Methylene chloride	49000	210000	1000	15UJ	28UJ	22UJ	1700U	1700U	25U	25UJ
n-Propylbenzene	--	--	--	31	20J	29U	11000	7800	22U	25U
Styrene	23000	97000	100000	11U	12U	15U	1700U	1700U	11U	12U
Tetrachloroethene	4000	6000	1000	11U	12U	15U	1700U	1700U	11U	12U
Toluene	1000000	1000000	500000	3J	12U	15U	1700U	1700U	2J	12U
Trichloroethene	23000	54000	1000	11U	12U	15U	1700U	1700U	11U	12U
Vinyl chloride	2000	7000	10000	11U	12U	15U	1700UJ	1700UJ	11UJ	12U
Xylenes (Total)	410000	1000000	10000	10J	4J	15U	1700U	1700U	7J	12U
cis-1,3-Dichloropropene	4000	5000	1000	11U	12UJ	15U	1700U	1700U	11U	12U
trans-1,3-Dichloropropene	4000	5000	1000	11U	12U	15U	1700U	1700U	11U	12U
Total Volatile Organic Compounds				77	35	0	11530	8260	11	5

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N2TFSB4	N2TFSB4	N2TFSB5	N2TFSB5	N3TFSB1	N3TFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	02	02
				Zone **: N2TF	N2TF	N2TF	N2TF	N3TF	AP
				Date: 10/28/94	10/28/94	10/19/94	10/19/94	10/18/94	10/19/94
1,1,1-Trichloroethane	210000	1000000	50000	13U	1500U	11U	57U	11U	11U
1,1,2,2-Tetrachloroethane	34000	70000	1000	13U	1500U	11U	57U	11U	11U
1,1,2-Trichloroethane	22000	420000	1000	13U	1500U	11U	57U	11U	11U
1,1-Dichloroethane	570000	1000000	10000	13U	1500U	11U	57U	11U	11U
1,1-Dichloroethene	8000	150000	10000	13U	1500UJ	11U	57U	11U	11U
1,2-Dibromoethane	--	--	--	26U	3100U	23U	110U	23U	23U
1,2-Dichloroethane	8000	24000	1000	13U	1500U	11U	57U	11U	11U
1,2-Dichloroethene(Total)	1079000	2000000	51000	13U	1500U	11U	57U	11U	11U
1,2-Dichloropropane	10000	43000	--	13U	1500UJ	11U	57U	11U	11U
1-Butanol	--	--	--	660U	78000UJ	570UJ	2800U	570U	570U
2-Butanol	--	--	--	660U	78000U	570U	2800U	570U	570U
2-Butanone	1000000	1000000	50000	13UJ	1500UJ	39J	57UJ	25J	14J
2-Hexanone	--	--	--	13U	1500UJ	11UJ	57U	11U	11U
2-Methyl-2-propanol	--	--	--	660U	78000UJ	570U	2800U	570U	570U
2-Propanol	--	--	--	660UJ	78000U	570UJ	2800UJ	570UJ	570UJ
4-Methyl-2-pentanone	1000000	1000000	50000	13U	1500U	11UJ	57U	11U	11U
Acetone	1000000	1000000	100000	13UJ	1500UJ	55UJ	85UJ	120U	86UJ
Benzene	3000	13000	1000	13U	290J	11U	57U	5J	11U
Bromodichloromethane	11000	46000	1000	13U	1500U	11U	57U	11U	11U
Bromoform	86000	370000	1000	13U	1500U	11U	57U	11U	11U
Bromomethane	79000	1000000	1000	13U	1500U	11U	57U	11U	11U
Carbon disulfide	--	--	--	13U	1500UJ	11U	57U	2J	11U
Carbon tetrachloride	2000	4000	1000	13U	1500U	11U	57U	11U	11U
Chlorobenzene	37000	680000	1000	13U	1500U	11U	57U	10J	2J
Chloroethane	--	--	--	13U	1500U	11U	57U	11U	11U
Chloroform	19000	28000	1000	13U	1500U	11U	57U	11U	11U
Chloromethane	520000	1000000	10000	13U	1500UJ	11UJ	57U	11U	11U
Dibromochloromethane	110000	1000000	1000	13U	1500U	11U	57U	11U	11U
Ethylbenzene	1000000	1000000	100000	13U	8700	11U	57U	10J	6J
Hexane	--	--	--	3J	7100J	23U	290	23	4J
Methyl-t-butyl ether	--	--	--	26U	3100U	23U	110U	23U	23U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N2TFSB4	N2TFSB4	N2TFSB5	N2TFSB5	N3TFSB1	N3TFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	02	02
				Zone*: N2TF	N2TF	N2TF	N2TF	N3TF	AP
				Date: 10/28/94	10/28/94	10/19/94	10/19/94	10/18/94	10/19/94
Methylene chloride	49000	210000	1000	48UJ	1500U	15UJ	120UJ	29U	37UJ
n-Propylbenzene	--	--	--	26U	6300	23U	260	46	23U
Styrene	23000	97000	100000	13U	1500U	11U	57U	11U	11U
Tetrachloroethene	4000	6000	1000	13U	1500U	11U	57U	11U	11U
Toluene	1000000	1000000	500000	13U	5000	11U	57U	3J	11U
Trichloroethene	23000	54000	1000	13U	1500U	11U	57U	11U	11U
Vinyl chloride	2000	7000	10000	13U	1500U	11U	57U	11U	11U
Xylenes (Total)	410000	1000000	10000	3J	36000	11U	11J	11	7J
cis-1,3-Dichloropropene	4000	5000	1000	13U	1500U	11U	57UJ	11UJ	11U
trans-1,3-Dichloropropene	4000	5000	1000	13U	1500U	11U	57U	11U	11U
Total Volatile Organic Compounds				6	63390	39	561	135	33

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB2	N3TFSB2FR	N3TFSB3	N3TFSB4	N3TFSB5	N3TFSB6
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	08	02	02	08	02
				Zone **: AP	AP	N3TF	N3TF	N3TF	N3TF
				Date: 10/19/94	10/19/94	10/13/94	10/17/94	10/19/94	10/18/94
1,1,1-Trichloroethane	210000	1000000	50000	68U	66U	12U	12U	1400U	1400U
1,1,2,2-Tetrachloroethane	34000	70000	1000	68U	66U	12U	12U	1400U	1400U
1,1,2-Trichloroethane	22000	420000	1000	68U	66U	12U	12U	1400U	1400U
1,1-Dichloroethane	570000	1000000	10000	68U	66U	12U	12U	1400U	1400U
1,1-Dichloroethene	8000	150000	10000	68U	66U	12U	12U	1400U	1400U
1,2-Dibromoethane	--	--	--	140U	130UJ	24U	24U	2900U	3000U
1,2-Dichloroethane	6000	24000	1000	68U	66U	12U	12U	1400U	1400U
1,2-Dichloroethene(Total)	1079000	2000000	51000	68U	66U	12U	12U	1400U	1400U
1,2-Dichloropropane	10000	43000	--	68U	66U	12U	12U	1400U	1400UJ
1-Butanol	--	--	--	3400UJ	3300UJ	600UJ	600U	74000UJ	74000U
2-Butanol	--	--	--	3400U	3300UJ	600U	600U	74000U	74000U
2-Butanone	1000000	1000000	50000	68UJ	66UJ	12UJ	12UJ	1400UJ	1400UJ
2-Hexanone	--	--	--	68U	66U	12U	12U	1400UJ	1400UJ
2-Methyl-2-propanol	--	--	--	3400U	3300UJ	600UJ	600U	74000U	74000U
2-Propanol	--	--	--	3400UJ	3300UJ	600UJ	600U	74000UJ	74000U
4-Methyl-2-pentanone	1000000	1000000	50000	68U	66U	12U	12U	1400UJ	1400U
Acetone	1000000	1000000	100000	180UJ	180UJ	24U	87U	1400UJ	1400UJ
Benzene	3000	13000	1000	68U	66U	12U	12U	1400U	1400U
Bromodichloromethane	11000	48000	1000	68U	66U	12U	12U	1400U	1400U
Bromoform	86000	370000	1000	68U	66U	12U	12U	1400U	1400U
Bromomethane	79000	1000000	1000	68U	66U	12UJ	12U	1400U	1400U
Carbon disulfide	--	--	--	68U	66U	12U	12U	1400UJ	1400U
Carbon tetrachloride	2000	4000	1000	68U	66U	12U	12U	1400U	1400U
Chlorobenzene	37000	680000	1000	68U	66U	12U	12U	1400U	3500
Chloroethane	--	--	--	68U	66U	12UJ	12U	1400U	1400U
Chloroform	19000	28000	1000	68U	66U	12U	12U	1400U	1400U
Chloromethane	520000	1000000	10000	68UJ	66UJ	12UJ	12UJ	1400UJ	1400UJ
Dibromochloromethane	110000	1000000	1000	68U	66U	12U	12U	1400U	1400U
Ethylbenzene	1000000	1000000	100000	68U	66U	12U	12U	3100J	1400U
Hexane	--	--	--	350J	380J	24U	24U	3000J	10000J
Methyl-t-butyl ether	--	--	--	140U	130UJ	24U	24U	2900U	3000U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB2	N3TFSB2FR	N3TFSB3	N3TFSB4	N3TFSB5	N3TFSB6
				Depth: 06	06	02	02	08	02
				Zone **: AP	AP	N3TF	N3TF	N3TF	N3TF
	Residential	Non-Residential	Impact to Groundwater	Date: 10/19/94	10/19/94	10/13/94	10/17/94	10/19/94	10/18/94
Methylene chloride	49000	210000	1000	120UJ	150UJ	26U	56U	1400U	1400U
n-Propylbenzene	--	--	--	3500J	1700J	24U	24U	8800J	14000
Styrene	23000	97000	100000	68U	68U	12U	12U	1400U	1400U
Tetrachloroethene	4000	6000	1000	68U	68U	12U	12U	1400U	1400U
Toluene	1000000	1000000	500000	68U	68U	12U	1J	1400U	1400U
Trichloroethene	23000	54000	1000	68U	66U	12U	12U	1400U	1400U
Vinyl chloride	2000	7000	10000	68UJ	68UJ	12UJ	12U	1400UJ	1400U
Xylenes (Total)	410000	1000000	10000	68U	68U	12U	12U	3400J	1400U
cis-1,3-Dichloropropene	4000	5000	1000	68U	66U	12U	12U	1400U	1400U
trans-1,3-Dichloropropene	4000	5000	1000	68U	66U	12U	12U	1400U	1400U
Total Volatile Organic Compounds				3850	2080	0	1	18300	27500

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB7	N3TFSB7	N3TFSB8	N3TFSB8	N3TFSB9	PN1SB2	PN1SB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	02	04	08
				Zone **: N3TF	N3TF	N3TF	N3TF	N3TF	P1	P1
				Date: 10/18/94	10/18/94	10/18/94	10/18/94	11/02/94	11/02/94	11/02/94
1,1,1-Trichloroethane	210000	1000000	50000	3000U	12U	1400U	1500U	13U	11U	12U
1,1,2,2-Tetrachloroethane	34000	70000	1000	3000U	12U	1400U	1500U	13U	11U	12U
1,1,2-Trichloroethane	22000	420000	1000	3000U	12U	1400U	1500U	13U	11U	12U
1,1-Dichloroethane	570000	1000000	10000	3000U	12U	1400U	1500U	13U	11U	12U
1,1-Dichloroethene	8000	150000	10000	3000U	12U	1400U	1500U	13U	11U	12U
1,2-Dibromoethane	--	--	--	6000U	24U	2800U	3000U	25U	22U	24U
1,2-Dichloroethane	6000	24000	1000	3000U	12U	1400U	1500U	13U	11U	12U
1,2-Dichloroethene(Total)	1079000	2000000	51000	3000U	12U	1400U	1500U	13U	11U	12U
1,2-Dichloropropane	10000	43000	--	3000U	12U	1400U	1500U	13U	11U	12U
1-Butanol	--	--	--	150000UJ	600U	70000UJ	780000J	630U	560U	590U
2-Butanol	--	--	--	150000UJ	600U	70000UJ	78000UJ	630U	560U	590U
2-Butanone	1000000	1000000	50000	3000UJ	44J	1400UJ	1500UJ	48J	4J	39J
2-Hexanone	--	--	--	3000UJ	12U	1400UJ	1500UJ	13U	11U	12U
2-Methyl-2-propanol	--	--	--	150000UJ	600U	70000UJ	76000UJ	630U	560U	590U
2-Propanol	--	--	--	150000UJ	600UJ	70000UJ	76000UJ	630UJ	560UJ	17J
4-Methyl-2-pentanone	1000000	1000000	50000	3000U	12U	1400U	1500U	13U	11U	12U
Acetone	1000000	1000000	100000	18000J	34U	1400UJ	1500UJ	180UJ	44UJ	100UJ
Benzene	3000	13000	1000	11000	26	4200	180J	13U	11U	12U
Bromodichloromethane	11000	46000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Bromoform	86000	370000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Bromomethane	79000	1000000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Carbon disulfide	--	--	--	3000U	12U	1400UJ	1500UJ	13U	11U	12U
Carbon tetrachloride	2000	4000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Chlorobenzene	37000	680000	1000	790J	12U	1400U	1500U	13U	11U	12U
Chloroethane	--	--	--	3000U	12U	1400U	1500U	13U	11U	12U
Chloroform	19000	28000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Chloromethane	520000	1000000	10000	3000U	12U	1400U	1500UJ	13U	11U	12U
Dibromochloromethane	110000	1000000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Ethylbenzene	1000000	1000000	100000	36000	52	1400	420J	13U	11U	12U
Hexane	--	--	--	120000J	45	5300	3000U	110J	5J	24U
Methyl-t-butyl ether	--	--	--	6000U	24U	2800U	3000U	25U	22U	24U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB7	N3TFSB7	N3TFSB8	N3TFSB8	N3TFSB9	PN1SB2	PN1SB2
				Depth: 02	06	02	06	02	04	08
				Zone **: N3TF	N3TF	N3TF	N3TF	N3TF	P1	P1
	Residential	Non-Residential	Impact to Groundwater	Date: 10/18/94	10/18/94	10/18/94	10/18/94	11/02/94	11/02/94	11/02/94
Methylene chloride	49000	210000	1000	3000U	27U	1400U	1500U	14UJ	38UJ	15UJ
n-Propylbenzene	--	--	--	37000	460J	8800	4800J	75J	22U	25
Styrene	23000	97000	100000	3000U	12U	1400U	1500U	13U	11U	12U
Tetrachloroethene	4000	6000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Toluene	1000000	1000000	500000	430J	2J	190J	1500U	13U	21	12U
Trichloroethene	23000	54000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Vinyl chloride	2000	7000	10000	3000U	12U	1400U	1500UJ	13U	11U	12U
Xylenes (Total)	410000	1000000	10000	42000	56	1700	330J	7J	11U	2J
cis-1,3-Dichloropropene	4000	5000	1000	3000U	12U	1400U	1500U	13U	11U	12U
trans-1,3-Dichloropropene	4000	5000	1000	3000U	12U	1400U	1500U	13U	11U	12U
Total Volatile Organic Compounds				265220	685	21590	785730	240	30	83

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: PSSB1	PSSB1	SSB1	SSB3	SSB3	STFSB1	STFSB1	STFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	16	06	10	02	06	08
				Zone **: MB	MB	SS	SS	SS	STF	STF	STF
				Date: 10/31/94	10/31/94	10/24/94	10/24/94	10/24/94	10/26/94	10/26/94	10/26/94
1,1,1-Trichloroethane	210000	1000000	50000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
1,1,2,2-Tetrachloroethane	34000	70000	1000	1400U	1400U	12U	16U	13U	1400U	1600UJ	1500UJ
1,1,2-Trichloroethane	22000	420000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
1,1-Dichloroethane	570000	1000000	10000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
1,1-Dichloroethene	8000	150000	10000	1400U	1400U	12U	16U	13U	1400U	1600UJ	1500UJ
1,2-Dibromoethane	--	--	--	2900U	2900U	24U	33U	26U	2800U	3300U	3200U
1,2-Dichloroethane	6000	24000	1000	1400UJ	1400U	12U	16U	13U	1400UJ	1600U	1500U
1,2-Dichloroethene(Total)	1079000	2000000	51000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
1,2-Dichloropropane	10000	43000	--	1400U	1400U	12U	16U	13U	1400U	1600UJ	1500UJ
1-Butanol	--	--	--	73000U	73000UJ	590U	820U	660U	70000U	83000UJ	80000UJ
2-Butanol	--	--	--	73000U	73000U	590U	820U	660U	70000U	83000U	80000U
2-Butanone	1000000	1000000	50000	1400UJ	1400UJ	12UJ	16UJ	8J	1400U	1600UJ	1500UJ
2-Hexanone	--	--	--	1400UJ	1400UJ	12U	16U	13U	1400UJ	1600UJ	1500UJ
2-Methyl-2-propanol	--	--	--	73000U	73000U	590U	820U	660U	70000U	83000U	80000U
2-Propanol	--	--	--	73000U	73000U	590UJ	820UJ	660UJ	70000U	83000U	80000U
4-Methyl-2-pentanone	1000000	1000000	50000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Acetone	1000000	1000000	100000	1400UJ	1400UJ	67U	16U	120U	1400UJ	1800UJ	1500UJ
Benzene	3000	13000	1000	1400U	1400U	12U	16U	13U	290J	260J	1500U
Bromodichloromethane	11000	46000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Bromoform	86000	370000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Bromomethane	79000	1000000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Carbon disulfide	--	--	--	1400U	1400U	12U	16U	13U	1400UJ	1600UJ	1500UJ
Carbon tetrachloride	2000	4000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Chlorobenzene	37000	680000	1000	1400U	1400U	1J	16U	13U	1400U	200J	1500U
Chloroethane	--	--	--	1400U	1400U	12U	16U	13U	1400UJ	1600U	1500U
Chloroform	19000	28000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Chloromethane	520000	1000000	10000	1400U	1400U	12U	16U	13U	1400UJ	1600U	1500U
Dibromochloromethane	110000	1000000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Ethylbenzene	1000000	1000000	100000	1400U	570J	12U	16U	13U	350J	480J	1500U
Hexane	--	--	--	2900U	1100J	5J	7J	26U	2800U	6100	3200U
Methyl-t-butyl ether	--	--	--	2900U	2900U	10J	33U	26U	2800U	3300U	3200U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: PSSB1	PSSB1	SSB1	SSB3	SSB3	STFSB1	STFSB1	STFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	16	06	10	02	06	08
				Zone **: MB	MB	SS	SS	SS	STF	STF	STF
				Date: 10/31/94	10/31/94	10/24/94	10/24/94	10/24/94	10/26/94	10/26/94	10/26/94
Methylene chloride	49000	210000	1000	1400U	1400U	45UJ	35UJ	48UJ	1400U	1600U	1500U
n-Propylbenzene	--	--	--	2900U	7300	14J	33U	1J	16000	130000	860J
Styrene	23000	97000	100000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Tetrachloroethene	4000	6000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Toluene	1000000	1000000	500000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Trichloroethene	23000	54000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Vinyl chloride	2000	7000	10000	1400U	1400U	12U	16U	13U	1400UJ	1600U	1500U
Xylenes (Total)	410000	1000000	10000	1400U	1200J	2J	16U	13U	1400U	1600U	1500U
cis-1,3-Dichloropropene	4000	5000	1000	1400U	1400U	12U	16U	13U	1400UJ	1600U	1500U
trans-1,3-Dichloropropene	4000	5000	1000	1400U	1400U	12U	16U	13U	1400U	1600U	1500U
Total Volatile Organic Compounds				0	10170	18	7	8	16640	137040	860

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA1-100594	FBNA5-101994	FBNA6-102094	FBNA7-102594	FBNA9-102694
	Residential	Non-Residential	Impact to Groundwater	Depth:	10/19/94	10/20/94	10/25/94	10/26/94
				Zone**: Date: 10/05/94				
1,1,1-Trichloroethane	210000	1000000	50000	10U	10U	10U	10U	10U
1,1,2,2-Tetrachloroethane	34000	70000	1000	10U	10U	10U	10U	10U
1,1,2-Trichloroethane	22000	420000	1000	10U	10U	10U	10U	10U
1,1-Dichloroethane	570000	1000000	10000	10U	10U	10U	10U	10U
1,1-Dichloroethane	8000	150000	10000	10U	10U	10U	10U	10U
1,2-Dibromoethane	--	--	--	20U	20U	20U	20U	20U
1,2-Dichloroethane	6000	24000	1000	10U	10U	10U	10U	10U
1,2-Dichloroethane(Total)	1079000	2000000	51000	10U	10U	10U	10U	10U
1,2-Dichloropropane	10000	43000	--	10U	10U	10U	10U	10U
1-Butanol	--	--	--	500U	500U	500U	500U	500U
2-Butanol	--	--	--	500U	500U	500U	500U	500U
2-Butanone	1000000	1000000	50000	10U	10U	10U	10U	10U
2-Hexanone	--	--	--	10U	10U	10U	10U	10U
2-Methyl-2-propanol	--	--	--	500U	500U	500U	500U	500U
2-Propanol	--	--	--	500U	500U	500U	500U	500U
4-Methyl-2-pentanone	1000000	1000000	50000	10U	10U	10U	10U	10U
Acetone	1000000	1000000	100000	140J	10U	10U	10U	10U
Benzene	3000	13000	1000	10U	10U	10U	10U	10U
Bromodichloromethane	11000	46000	1000	10U	10U	10U	10U	10U
Bromoform	86000	370000	1000	10U	10U	10U	10U	10U
Bromomethane	79000	1000000	1000	10U	10U	10U	10U	10U
Carbon disulfide	--	--	--	10U	10U	10U	10U	10U
Carbon tetrachloride	2000	4000	1000	10U	10U	10U	10U	10U
Chlorobenzene	37000	680000	1000	10U	10U	10U	10U	10U
Chloroethane	--	--	--	10U	10U	10U	10U	10U
Chloroform	19000	28000	1000	10U	10U	10U	10U	10U
Chloromethane	520000	1000000	10000	10U	10U	10U	10U	10U
Dibromochloromethane	110000	1000000	1000	10U	10U	10U	10U	10U
Ethylbenzene	1000000	1000000	100000	10U	10U	10U	10U	10U
Hexane	--	--	--	10U	10U	10U	10U	10U
Methyl-t-butyl ether	--	--	--	20U	20U	20U	20U	20U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA1-100594	FBNA5-101994	FBNA6-102094	FBNA7-102594	FBNA9-102694	
	Residential	Non-Residential	Impact to Groundwater	Depth:	Date: 10/05/94	10/19/94	10/20/94	10/25/94	10/26/94
				Zone**:					
Methylene chloride	49000	210000	1000	2J	5J	10U	3J	10U	
n-Propylbenzene	--	--	--	20U	20U	20U	20U	20U	
Styrene	23000	97000	100000	20U	20U	20U	20U	20U	
Tetrachloroethene	4000	8000	1000	10U	10U	10U	10U	10U	
Toluene	1000000	1000000	500000	10U	10U	10U	10U	10U	
Trichloroethene	23000	54000	1000	10U	10U	10U	10U	10U	
Vinyl chloride	2000	7000	10000	10U	10U	10U	10U	10U	
Xylenes (Total)	410000	1000000	10000	10U	10U	10U	10U	10U	
cis-1,3-Dichloropropene	4000	5000	1000	10U	10U	10U	10U	10U	
trans-1,3-Dichloropropene	4000	5000	1000	10U	10U	10U	10U	10U	
Total Volatile Organic Compounds				0	5	0	3	0	

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA11-102794	FBNA13-102894	FBNA14-102894	FBNA17-103194
	Residential	Non-Residential	Impact to Groundwater	Depth:			
				Zone**:			
				Date: 10/27/94	10/28/94	10/28/94	10/31/94
1,1,1-Trichloroethane	210000	1000000	50000	25U	10U	10U	10U
1,1,2,2-Tetrachloroethane	34000	70000	1000	25U	10U	10U	10U
1,1,2-Trichloroethane	22000	420000	1000	25U	10U	10U	10U
1,1-Dichloroethane	570000	1000000	10000	25U	10U	10U	10U
1,1-Dichloroethane	8000	150000	10000	25U	10U	10U	10U
1,2-Dibromoethane	--	--	--	50U	20U	20U	20U
1,2-Dichloroethane	6000	24000	1000	25U	10U	10U	10U
1,2-Dichloroethane(Total)	1079000	2000000	51000	25U	10U	10U	10U
1,2-Dichloropropane	10000	43000	--	25U	10U	10U	10U
1-Butanol	--	--	--	1200U	500U	500U	500U
2-Butanol	--	--	--	1200U	500U	500U	500U
2-Butanone	1000000	1000000	50000	25U	10U	10U	10U
2-Hexanone	--	--	--	25U	10U	10U	10U
2-Methyl-2-propanol	--	--	--	1200U	500U	500U	500U
2-Propanol	--	--	--	1200U	500U	500U	500U
4-Methyl-2-pentanone	1000000	1000000	50000	25U	10U	10U	10U
Acetone	1000000	1000000	100000	330	10U	6J	10U
Benzene	3000	13000	1000	25U	10U	10U	10U
Bromodichloromethane	11000	46000	1000	25U	10U	10U	10U
Bromoform	86000	370000	1000	25U	10U	10U	10U
Bromomethane	79000	1000000	1000	25U	10U	10U	10U
Carbon disulfide	--	--	--	25U	10U	10U	10U
Carbon tetrachloride	2000	4000	1000	25U	10U	10U	10U
Chlorobenzene	37000	680000	1000	25U	10U	10U	10U
Chloroethane	--	--	--	25U	10U	10U	10U
Chloroform	19000	28000	1000	25U	10U	10U	10U
Chloromethane	520000	1000000	10000	25U	10U	10U	10U
Dibromochloromethane	110000	1000000	1000	25U	10U	10U	10U
Ethylbenzene	1000000	1000000	100000	25U	10U	10U	10U
Hexane	--	--	--	25U	10U	10U	10U
Methyl-t-butyl ether	--	--	--	50U	20U	20U	20U

See last page for footnotes.



Table 5-2. Volatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA11-102794	FBNA13-102894	FBNA14-102894	FBNA17-103194	
	Residential	Non-Residential	Impact to Groundwater	Depth:	Date: 10/27/94	10/28/94	10/28/94	10/31/94
				Zone **:				
Methylene chloride	49000	210000	1000	25U	3J	2J	1J	
n-Propylbenzene	--	--	--	50U	20U	20U	20U	
Styrene	23000	97000	100000	50U	20U	20U	20U	
Tetrachloroethene	4000	6000	1000	25U	10U	10U	10U	
Toluene	1000000	1000000	500000	25U	10U	10U	10U	
Trichloroethene	23000	54000	1000	25U	10U	10U	10U	
Vinyl chloride	2000	7000	10000	25U	10U	10U	10U	
Xylenes (Total)	410000	1000000	10000	25U	10U	10U	10U	
cis-1,3-Dichloropropene	4000	5000	1000	25U	10U	10U	10U	
trans-1,3-Dichloropropene	4000	5000	1000	25U	10U	10U	10U	
Total Volatile Organic Compounds				0	3	8	1	

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per kilogram (ug/kg) (equivalent to parts per billion [ppb]).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP)

protocols contained in the Statement of Work (SOW) OLM01.8.

Sample results exceeding the NJDEP impact to groundwater criteria are shown in bold. Sample results exceeding the NJDEP non-residential criteria are underlined.

Sample results exceeding both criteria are shown in bold and underlined.

NJDEP New Jersey Department of Environmental Protection.

FBNA Indicates a field blank associated with non-aqueous samples.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specific detection limit.

J Estimated result.

-- No applicable criteria.

* NJDEP Soil Cleanup Criteria, February 3, 1992; last revised February 3, 1994.

** Zones as defined in Table 3-2.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: 3TFIRMB4	3TFIRMB4	AGTFSB1	AGTFSB1	AGTFSB2	AGTFSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	04	02
				Zone*: N3TF	N3TF	AGTF	AGTF	AGTF	AGTF
				Date: 10/17/94	10/17/94	10/20/94	10/20/94	10/28/94	10/27/94
1,2,4-Trichlorobenzene	68000	1200000	100000	390U	7800U	8500U	13000UJ	10000U	800U
1,2-Dichlorobenzene	5100000	10000000	50000	240J	7800U	8500U	13000UJ	10000U	800U
1,3-Dichlorobenzene	5100000	10000000	100000	140J	7800U	8500U	13000UJ	10000U	800U
1,4-Dichlorobenzene	570000	10000000	100000	200J	7800U	8500U	13000UJ	10000U	800U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	390U	7800U	8500U	13000UJ	10000U	800U
2,4,5-Trichlorophenol	5600000	10000000	50000	950U	19000U	21000U	32000UJ	26000U	1900U
2,4,6-Trichlorophenol	62000	270000	10000	390U	7800U	8500U	13000UJ	10000U	800U
2,4-Dichlorophenol	170000	3100000	10000	390U	7800U	8500U	13000UJ	10000U	800U
2,4-Dimethylphenol	1100000	10000000	10000	390U	7800U	8500U	13000UJ	10000U	800U
2,4-Dinitrophenol	110000	2100000	10000	950U	19000U	21000U	32000UJ	26000UJ	1900UJ
2,4-Dinitrotoluene	1000	4000	10000	390U	7800U	8500U	13000UJ	10000U	800U
2,6-Dinitrotoluene	1000	4000	10000	390U	7800U	8500U	13000UJ	10000U	800U
2-Chloronaphthalene	--	--	--	390U	7800U	8500U	1900J	10000U	800U
2-Chlorophenol	280000	5200000	10000	390U	7800U	8500U	13000UJ	10000U	800U
2-Methylnaphthalene	--	--	--	46J	24000	9400	45000J	20000	120J
2-Methylphenol	2800000	10000000	--	390U	7800U	8500U	13000UJ	10000U	800U
2-Nitroaniline	--	--	--	950U	19000U	21000U	32000UJ	26000U	1900U
2-Nitrophenol	--	--	--	390U	7800U	8500U	13000UJ	10000U	800U
3,3'-Dichlorobenzidine	2000	6000	100000	390U	7800UJ	8500UJ	13000UJ	10000UJ	800UJ
3-Nitroaniline	--	--	--	950U	19000U	21000U	32000UJ	26000U	1900U
4,6-Dinitro-2-methylphenol	--	--	--	950U	19000UJ	21000UJ	32000UJ	26000UJ	1900UJ
4-Bromophenyl phenyl ether	--	--	--	390U	7800U	8500U	13000UJ	10000U	800U
4-Chloro-3-methylphenol	10000000	10000000	100000	390U	7800U	8500U	13000UJ	10000U	800U
4-Chloroaniline	230000	4200000	--	390U	7800U	8500U	13000UJ	10000U	800U
4-Chlorophenyl phenyl ether	--	--	--	390U	7800U	8500U	13000UJ	10000U	800U
4-Methylphenol	2800000	10000000	--	390U	7800U	8500U	13000UJ	10000U	800U
4-Nitroaniline	--	--	--	950U	19000UJ	21000UJ	32000UJ	26000U	1900U
4-Nitrophenol	--	--	--	950U	19000UJ	21000UJ	32000UJ	26000U	1900UJ
Acenaphthene	3400000	10000000	100000	390U	7800U	8500U	13000UJ	10000U	88J
Acenaphthylene	--	--	--	390U	7800U	8500U	13000UJ	10000U	800U
Anthracene	10000000	10000000	100000	390U	7800U	2100J	1400J	1800J	320J
Benzo(a)anthracene	900	4000	500000	410	1700J	2000J	2000J	9000J	1600J
Benzo(a)pyrene	660	660	100000	270J	1700J	1500J	13000UJ	12000	2200J

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: 3TFIRMB4	3TFIRMB4	AGTFSB1	AGTFSB1	AGTFSB2	AGTFSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	04	02
				Zone*: N3TF	N3TF	AGTF	AGTF	AGTF	AGTF
				Date: 10/17/94	10/17/94	10/20/94	10/20/94	10/28/94	10/27/94
Benzo(b)fluoranthene	900	4000	50000	850J	1800J	1700J	13000UJ	8400J	1700J
Benzo(g,h,i)perylene	--	--	--	390UJ	940J	2100J	13000UJ	6900J	2800J
Benzo(k)fluoranthene	900	4000	500000	990J	1800J	1700J	13000UJ	8700J	1900J
Butyl benzyl phthalate	1100000	10000000	100000	390U	7800U	8500U	13000UJ	10000U	800UJ
Carbazole	--	--	--	390U	7800U	8500U	13000UJ	10000U	800U
Chrysene	9000	40000	500000	1100	3200J	5000J	3300J	12000	2900J
Di-n-butyl phthalate	5700000	10000000	100000	390U	7800U	8500U	13000UJ	10000U	87J
Di-n-octyl phthalate	1100000	10000000	100000	390UJ	7800U	8500U	13000UJ	10000UJ	800UJ
Dibenzo(a,h)anthracene	660	660	100000	180J	7800U	8500U	13000UJ	5400J	800UJ
Dibenzofuran	--	--	--	390U	7800U	8500U	13000UJ	1600J	800U
Diethyl phthalate	10000000	10000000	50000	390U	7800U	8500U	13000UJ	10000U	800U
Dimethyl phthalate	10000000	10000000	50000	390U	7800U	8500U	13000UJ	10000U	800U
Fluoranthene	2300000	10000000	100000	440	2200J	1500J	1400J	5000J	1200
Fluorene	2300000	10000000	100000	390U	5700J	8500U	5000J	3900J	130J
Hexachlorobenzene	660	2000	100000	390U	7800U	8500U	13000UJ	10000U	800U
Hexachlorobutadiene	1000	21000	100000	390U	7800U	8500U	13000UJ	10000U	800U
Hexachlorocyclopentadiene	400000	7300000	100000	390U	7800U	8500U	13000UJ	10000U	800U
Hexachloroethane	6000	100000	100000	390U	7800U	8500U	13000UJ	10000U	800U
Indeno(1,2,3-cd)pyrene	900	4000	500000	150J	850J	500J	13000UJ	4600J	960J
Isophorone	1100000	10000000	50000	390U	7800U	8500U	13000UJ	10000U	800U
N-Nitroso-di-n-propylamine	660	660	10000	390U	7800U	8500U	13000UJ	10000U	800U
N-Nitrosodiphenylamine	140000	600000	100000	390U	7800U	8500U	13000UJ	10000U	800U
Naphthalene	230000	4200000	100000	64J	7800U	8500U	13000UJ	10000U	800U
Nitrobenzene	28000	520000	10000	390U	7800U	8500U	13000UJ	10000U	800U
Pentachlorophenol	6000	24000	100000	950U	19000U	21000U	32000UJ	26000U	1900UJ
Phenanthrene	--	--	--	630	6400J	6800J	13000J	14000	1200
Phenol	10000000	10000000	50000	390U	7800U	8500U	13000UJ	10000U	800U
Pyrene	1700000	10000000	100000	780	3000J	11000	8400J	8900J	3700J
bis(2-Chloroethoxy)methane	--	--	--	390U	7800U	8500U	13000UJ	10000U	800U
bis(2-Chloroethyl)ether	660	3000	10000	390U	7800U	8500U	13000UJ	10000U	800U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	390U	7800U	8500U	13000UJ	10000U	800UJ
Total Semivolatile Compounds				6490	53290	45300	81400	122200	20905

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: AGTFSB3	AGTFSB4	AHTFSB1	AHTFSB2	AHTFSB4	AHTFSB4
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	02	02	02	02	08
				Zone **: AGTF	AGTF	AHTF	AHTF	AHTF	AHTF
				Date: 10/27/94	10/20/94	10/19/94	10/14/94	10/14/94	10/14/94
1,2,4-Trichlorobenzene	68000	1200000	100000	24000U	3900U	7100U	3800U	3600U	3800U
1,2-Dichlorobenzene	5100000	10000000	50000	24000U	3900U	7100U	3800U	3600U	3800U
1,3-Dichlorobenzene	5100000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
1,4-Dichlorobenzene	570000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	24000U	3900U	7100U	3800U	3600U	3800U
2,4,5-Trichlorophenol	5800000	10000000	50000	61000U	9500U	17000U	9200U	8800U	9200U
2,4,6-Trichlorophenol	62000	270000	10000	24000U	3900U	7100U	3800U	3600U	3800U
2,4-Dichlorophenol	170000	3100000	10000	24000U	3900U	7100U	3800U	3600U	3800U
2,4-Dimethylphenol	1100000	10000000	10000	24000U	3900U	7100U	3800U	3600U	3800U
2,4-Dinitrophenol	110000	2100000	10000	61000UJ	9500U	17000UJ	9200UJ	8800UJ	9200U
2,4-Dinitrotoluene	1000	4000	10000	24000U	3900U	7100U	3800U	3600U	3800U
2,6-Dinitrotoluene	1000	4000	10000	24000U	3900U	7100U	3800U	3600U	3800U
2-Chloronaphthalene	--	--	--	24000U	3900U	7100U	3800U	3600U	3800U
2-Chlorophenol	280000	5200000	10000	24000U	3900U	7100U	3800U	3600U	3800U
2-Methylnaphthalene	--	--	--	24000U	3900U	1200J	780J	10000	25000
2-Methylphenol	2800000	10000000	--	24000U	3900U	7100U	3800U	3600U	3800U
2-Nitroaniline	--	--	--	61000U	9500U	17000U	9200UJ	8800UJ	9200U
2-Nitrophenol	--	--	--	24000U	3900U	7100U	3800U	3600U	3800U
3,3'-Dichlorobenzidine	2000	6000	100000	24000U	3900UJ	7100UJ	3800U	3600U	3800U
3-Nitroaniline	--	--	--	61000U	9500U	17000U	9200U	8800U	9200U
4,6-Dinitro-2-methylphenol	--	--	--	61000U	9500UJ	17000U	9200UJ	8800UJ	9200U
4-Bromophenyl phenyl ether	--	--	--	24000U	3900U	7100U	3800U	3600U	3800U
4-Chloro-3-methylphenol	10000000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
4-Chloroaniline	230000	4200000	--	24000UJ	3900U	7100U	3800U	3600U	3800U
4-Chlorophenyl phenyl ether	--	--	--	24000U	3900U	7100U	3800U	3600U	3800U
4-Methylphenol	2800000	10000000	--	24000U	3900U	7100U	3800U	3600U	3800U
4-Nitroaniline	--	--	--	61000U	9500UJ	17000U	9200U	8800U	9200U
4-Nitrophenol	--	--	--	61000U	9500UJ	17000UJ	9200UJ	8800UJ	9200U
Acenaphthene	3400000	10000000	100000	24000U	3900U	7100U	1300J	3600U	3800U
Acenaphthylene	--	--	--	24000U	3900U	7100U	3800U	3600U	3800U
Anthracene	10000000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Benzo(a)anthracene	900	4000	500000	4000J	3900U	7100U	3800U	3600U	410J
Benzo(a)pyrene	660	660	100000	2500J	1300J	7100U	3800U	3600U	3800U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: AGTFSB3	AGTFSB4	AHTFSB1	AHTFSB2	AHTFSB4	AHTFSB4
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	02	02	02	02	08
				Zone **: AGTF	AGTF	AHTF	AHTF	AHTF	AHTF
				Date: 10/27/94	10/20/94	10/19/94	10/14/94	10/14/94	10/14/94
Benzo(b)fluoranthene	900	4000	50000	24000U	1100J	7100U	3800U	3600U	3800U
Benzo(g,h,i)perylene	--	--	--	24000U	960J	7100U	3800UJ	3600UJ	3800U
Benzo(k)fluoranthene	900	4000	500000	24000U	1100J	7100U	3800U	3600U	3800U
Butyl benzyl phthalate	1100000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Carbazole	--	--	--	24000U	3900U	7100U	3800U	3600U	3800U
Chrysene	9000	40000	500000	7100J	840J	7100U	400J	1200J	1100J
Di-n-butyl phthalate	5700000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Di-n-octyl phthalate	1100000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Dibenzo(a,h)anthracene	660	660	100000	24000U	760J	7100U	3800UJ	3600UJ	3800U
Dibenzofuran	--	--	--	24000U	3900U	7100U	960J	3600U	3800U
Diethyl phthalate	10000000	10000000	50000	24000U	3900U	7100U	3800U	3600U	3800U
Dimethyl phthalate	10000000	10000000	50000	24000U	3900U	7100U	3800U	3600U	3800U
Fluoranthene	2300000	10000000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Fluorene	2300000	10000000	100000	3900J	3900U	7100U	1900J	1000J	3800U
Hexachlorobenzene	660	2000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Hexachlorobutadiene	1000	21000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Hexachlorocyclopentadiene	400000	7300000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Hexachloroethane	6000	100000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Indeno(1,2,3-cd)pyrene	900	4000	500000	24000U	740J	7100U	3800UJ	3600UJ	3800U
Isophorone	1100000	10000000	50000	24000U	3900U	7100U	3800U	3600U	3800U
N-Nitroso-di-n-propylamine	660	660	10000	24000U	3900U	7100U	3800U	3600U	3800U
N-Nitrosodiphenylamine	140000	600000	100000	24000UJ	3900U	7100U	3800U	3600U	3800U
Naphthalene	230000	4200000	100000	24000U	3900U	7100U	470J	550J	3800U
Nitrobenzene	28000	520000	10000	24000U	3900U	7100U	3800U	3600U	3800U
Pentachlorophenol	6000	24000	100000	61000U	9500U	17000UJ	9200U	8800U	9200U
Phenanthrene	--	--	--	9200J	3900U	7100U	4400	2800J	3600J
Phenol	10000000	10000000	50000	24000U	3900U	7100U	3800U	3600U	3800U
Pyrene	1700000	10000000	100000	11000J	690J	7100U	620J	1500J	420J
bis(2-Chloroethoxy)methane	--	--	--	24000U	3900U	7100U	3800U	3600U	3800U
bis(2-Chloroethyl)ether	660	3000	10000	24000U	3900U	7100U	3800U	3600U	3800U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	24000U	3900U	7100U	3800U	3600U	3800U
Total Semivolatile Compounds				37700	7490	1200	10830	17050	30530

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: APSB2	APSB3	APSB5	APSB5	APSB6	APSB6	DTSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	06	10	04
				Zone **: AP	AP	AP	AP	AP	AP	
				Date: 10/26/94	10/21/94	10/12/94	10/12/94	10/21/94	10/21/94	
1,2,4-Trichlorobenzene	88000	1200000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
1,2-Dichlorobenzene	5100000	10000000	50000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
1,3-Dichlorobenzene	5100000	10000000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
1,4-Dichlorobenzene	570000	10000000	100000	11000U	17000J	350U	4200U	22000UJ	4000J	37000U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	11000U	61000UJ	350UJ	4200U	22000UJ	24000UJ	37000U
2,4,5-Trichlorophenol	5600000	10000000	50000	26000U	150000UJ	840U	10000U	56000UJ	59000UJ	91000U
2,4,6-Trichlorophenol	62000	270000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2,4-Dichlorophenol	170000	3100000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2,4-Dimethylphenol	1100000	10000000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2,4-Dinitrophenol	110000	2100000	10000	26000U	150000UJ	840UJ	10000U	56000UJ	59000UJ	91000UJ
2,4-Dinitrotoluene	1000	4000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2,6-Dinitrotoluene	1000	4000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2-Chloronaphthalene	--	--	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2-Chlorophenol	280000	5200000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2-Methylnaphthalene	--	--	--	11000U	34000J	350U	7500	2300J	11000J	37000U
2-Methylphenol	2800000	10000000	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
2-Nitroaniline	--	--	--	26000U	150000UJ	840U	10000U	56000UJ	59000UJ	91000U
2-Nitrophenol	--	--	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
3,3'-Dichlorobenzidine	2000	6000	100000	11000UJ	61000UJ	350UJ	4200U	22000UJ	24000UJ	37000U
3-Nitroaniline	--	--	--	26000U	150000UJ	840U	10000U	56000UJ	59000UJ	91000U
4,6-Dinitro-2-methylphenol	--	--	--	26000U	150000UJ	840U	10000U	56000UJ	59000UJ	91000U
4-Bromophenyl phenyl ether	--	--	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
4-Chloro-3-methylphenol	10000000	10000000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
4-Chloroaniline	230000	4200000	--	11000UJ	61000UJ	350U	4200U	22000UJ	24000UJ	37000UJ
4-Chlorophenyl phenyl ether	--	--	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
4-Methylphenol	2800000	10000000	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
4-Nitroaniline	--	--	--	26000U	150000UJ	840U	10000U	56000UJ	59000UJ	91000U
4-Nitrophenol	--	--	--	26000U	150000UJ	840UJ	10000U	56000UJ	59000UJ	91000U
Acenaphthene	3400000	10000000	100000	11000U	61000UJ	350U	4200U	4200J	24000UJ	37000U
Acenaphthylene	--	--	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U
Anthracene	10000000	10000000	100000	11000U	61000UJ	350U	3100J	22000UJ	24000UJ	50000J
Benzo(a)anthracene	900	4000	500000	11000U	61000UJ	140J	8300	2600J	3000J	37000U
Benzo(a)pyrene	660	660	100000	11000U	61000UJ	R	5300	6000J	24000UJ	37000U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: APSB2		APSB3	APSB5	APSB5	APSB6	APSB6	DTSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02		06	02	06	06	10	04
				Zone **: AP		AP	AP	AP	AP	AP	DT
				Date: 10/26/94		10/21/94	10/12/94	10/12/94	10/21/94	10/21/94	10/27/94
Benzo(b)fluoranthene	900	4000	50000	11000U	61000UJ	R	3100J	2200J	24000UJ	37000U	
Benzo(g,h,i)perylene	--	--	--	11000U	61000UJ	R	2100J	22000UJ	24000UJ	37000U	
Benzo(k)fluoranthene	900	4000	500000	11000U	61000UJ	R	2900J	2400J	24000UJ	37000U	
Butyl benzyl phthalate	1100000	10000000	100000	11000U	61000UJ	350UJ	4200U	22000UJ	24000UJ	37000U	
Carbazole	--	--	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	18000J	
Chrysene	9000	40000	500000	11000U	61000UJ	190J	13000	7900J	5600J	4100J	
Di-n-butyl phthalate	5700000	10000000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Di-n-octyl phthalate	1100000	10000000	100000	11000U	61000UJ	R	4200U	22000UJ	24000UJ	37000U	
Dibenzo(a,h)anthracene	660	660	100000	11000U	61000UJ	R	4200U	22000UJ	24000UJ	37000U	
Dibenzofuran	--	--	--	11000U	61000UJ	350U	4200U	4300J	24000UJ	37000U	
Diethyl phthalate	10000000	10000000	50000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Dimethyl phthalate	10000000	10000000	50000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Fluoranthene	2300000	10000000	100000	11000U	61000UJ	180J	5800	3900J	24000UJ	4800J	
Fluorene	2300000	10000000	100000	11000U	61000UJ	350U	2900J	22000UJ	24000UJ	6300J	
Hexachlorobenzene	660	2000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Hexachlorobutadiene	1000	21000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Hexachlorocyclopentadiene	400000	7300000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Hexachloroethene	6000	100000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Indeno(1,2,3-cd)pyrene	900	4000	500000	11000U	61000UJ	R	1800J	22000UJ	24000UJ	37000U	
Isophorone	1100000	10000000	50000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
N-Nitroso-di-n-propylamine	660	660	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
N-Nitrosodiphenylamine	140000	500000	100000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000UJ	
Naphthalene	230000	4200000	100000	11000U	10000J	350U	4200U	22000UJ	24000UJ	37000U	
Nitrobenzene	28000	520000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Pentachlorophenol	6000	24000	100000	1400J	150000UJ	840UJ	10000U	56000UJ	59000UJ	91000U	
Phenanthrene	--	--	--	11000U	16000J	87J	18000	17000J	28000J	9000J	
Phenol	10000000	10000000	50000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
Pyrene	1700000	10000000	100000	11000U	10000J	620J	11000	12000J	6900J	8000J	
bis(2-Chloroethoxy)methane	--	--	--	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
bis(2-Chloroethyl)ether	660	3000	10000	11000U	61000UJ	350U	4200U	22000UJ	24000UJ	37000U	
bis(2-Ethylhexyl)phthalate	49000	210000	100000	11000U	61000UJ	940J	4200U	22000UJ	24000UJ	37000U	
Total Semivolatile Compounds				1400	87000	2137	82800	64800	58500	100200	

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: DTSB3FR	ECIRMB1	ECIRMB3	ECIRMB3	ECPSB1	ECPSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 04	02	02	06	02	06
				Zone **: DT	U	N3TF	N3TF	ECPS	ECPS
				Date: 10/27/94	10/24/94	10/19/94	10/19/94	10/20/94	10/20/94
1,2,4-Trichlorobenzene	88000	1200000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
1,2-Dichlorobenzene	5100000	10000000	50000	37000U	7600U	1600J	66000UJ	7600U	11000UJ
1,3-Dichlorobenzene	5100000	10000000	100000	37000U	7600U	3700U	66000UJ	7600U	1200J
1,4-Dichlorobenzene	570000	10000000	100000	37000U	7600U	530J	16000J	7600U	3600J
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2,4,5-Trichlorophenol	5600000	10000000	50000	91000U	18000U	9000U	160000UJ	18000U	29000UJ
2,4,6-Trichlorophenol	62000	270000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2,4-Dichlorophenol	170000	3100000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2,4-Dimethylphenol	1100000	10000000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2,4-Dinitrophenol	110000	2100000	10000	91000UJ	18000U	9000U	160000UJ	18000U	29000UJ
2,4-Dinitrotoluene	1000	4000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2,6-Dinitrotoluene	1000	4000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2-Chloronaphthalene	--	--	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2-Chlorophenol	280000	5200000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2-Methylnaphthalene	--	--	--	37000U	7600U	690J	59000J	930J	12000J
2-Methylphenol	2800000	10000000	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
2-Nitroaniline	--	--	--	91000U	18000U	9000U	160000UJ	18000U	29000UJ
2-Nitrophenol	--	--	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
3,3'-Dichlorobenzidine	2000	6000	100000	37000U	7600UJ	3700UJ	66000UJ	7600UJ	11000UJ
3-Nitroaniline	--	--	--	91000U	18000U	9000U	160000UJ	18000U	29000UJ
4,6-Dinitro-2-methylphenol	--	--	--	91000U	18000U	9000U	160000UJ	18000UJ	29000UJ
4-Bromophenyl phenyl ether	--	--	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
4-Chloro-3-methylphenol	10000000	10000000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
4-Chloroaniline	230000	4200000	--	37000UJ	7600UJ	3700U	66000UJ	7600U	11000UJ
4-Chlorophenyl phenyl ether	--	--	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
4-Methylphenol	2800000	10000000	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
4-Nitroaniline	--	--	--	91000U	18000U	9000UJ	160000UJ	18000UJ	29000UJ
4-Nitrophenol	--	--	--	91000U	18000U	9000UJ	160000UJ	18000UJ	29000UJ
Acenaphthene	3400000	10000000	100000	37000U	7600U	580J	66000UJ	7600U	11000UJ
Acenaphthylene	--	--	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Anthracene	10000000	10000000	100000	27000J	7600U	3700U	66000UJ	7600U	11000UJ
Benzo(a)anthracene	900	4000	500000	37000U	7600U	1500J	66000UJ	7600U	2900J
Benzo(a)pyrene	660	660	100000	37000U	<u>770J</u>	<u>2500J</u>	66000UJ	7600U	11000UJ

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: DTSB3FR	ECIRMB1	ECIRMB3	ECIRMB3	ECPSB1	ECPSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 04	02	02	06	02	06
				Zone **: DT	U	N3TF	N3TF	ECPS	ECPS
				Date: 10/27/94	10/24/94	10/19/94	10/19/94	10/20/94	10/20/94
Benzo(b)fluoranthene	900	4000	50000	37000U	1200J	2600J	66000UJ	7600U	1400J
Benzo(g,h,i)perylene	--	--	--	37000U	7600U	2600J	66000UJ	7600U	11000UJ
Benzo(k)fluoranthene	900	4000	500000	37000U	1200J	2500J	66000UJ	7600UJ	1400J
Butyl benzyl phthalate	1100000	10000000	100000	37000U	7800U	3700U	66000UJ	7600U	11000UJ
Carbazole	--	--	--	7800J	7600U	3700U	66000UJ	7600U	11000UJ
Chrysene	9000	40000	500000	37000U	1400J	3000J	66000UJ	1300J	5800J
Di-n-butyl phthalate	5700000	10000000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Di-n-octyl phthalate	1100000	10000000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Dibenzo(a,h)anthracene	660	660	100000	37000U	7600U	2300J	66000UJ	7600U	11000UJ
Dibenzofuran	--	--	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Diethyl phthalate	10000000	10000000	50000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Dimethyl phthalate	10000000	10000000	50000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Fluoranthene	2300000	10000000	100000	37000U	7600U	490J	66000UJ	7600U	11000UJ
Fluorene	2300000	10000000	100000	4700J	7600U	3700U	66000UJ	7600U	2700J
Hexachlorobenzene	660	2000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Hexachlorobutadiene	1000	21000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Hexachlorocyclopentadiene	400000	7300000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Hexachloroethane	6000	100000	100000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Indeno(1,2,3-cd)pyrene	900	4000	500000	37000U	7600U	1800J	66000UJ	7600U	11000UJ
Isophorone	1100000	10000000	50000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
N-Nitroso-di-n-propylamine	660	660	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
N-Nitrosodiphenylamine	140000	600000	100000	37000UJ	7600UJ	3700U	66000UJ	7600U	11000UJ
Naphthalene	230000	4200000	100000	37000U	7600U	690J	17000J	7600U	7500J
Nitrobenzene	28000	520000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Pentachlorophenol	6000	24000	100000	91000U	18000U	9000U	160000UJ	18000U	29000UJ
Phenanthrene	--	--	--	6800J	7600U	3700U	15000J	1500J	8000J
Phenol	10000000	10000000	50000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
Pyrene	1700000	10000000	100000	37000U	1100J	980J	66000UJ	970J	2700J
bis(2-Chloroethoxy)methane	--	--	--	37000U	7600U	3700U	66000UJ	7600U	11000UJ
bis(2-Chloroethyl)ether	660	3000	10000	37000U	7600U	3700U	66000UJ	7600U	11000UJ
bis(2-Ethylhexyl)phthalate	49000	210000	100000	37000U	7600U	890J	66000UJ	7600U	11000UJ
Total Semivolatile Compounds				46300	5670	25230	107000	4700	49000

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: ECPSB2	ECPSB4	ECPSB5	GFSB1	GTFIRMB1	GTFIRMB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 12	08	02	02	02	02
				Zone **: ECPS	ECPS	ECPS	STF	GTF	GTF
				Date: 10/20/94	10/19/94	10/19/94	10/12/94	11/16/94	10/17/94
1,2,4-Trichlorobenzene	68000	1200000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
1,2-Dichlorobenzene	5100000	10000000	50000	4700000J	24000UJ	7600U	3800U	1600U	370U
1,3-Dichlorobenzene	5100000	10000000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
1,4-Dichlorobenzene	570000	10000000	100000	240000J	24000UJ	820J	3800U	1600U	370U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	700000UJ	24000UJ	7600U	3800UJ	1600U	370U
2,4,5-Trichlorophenol	5600000	10000000	50000	1800000UJ	60000UJ	18000U	9100U	3800U	900U
2,4,6-Trichlorophenol	62000	270000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
2,4-Dichlorophenol	170000	3100000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
2,4-Dimethylphenol	1100000	10000000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
2,4-Dinitrophenol	110000	2100000	10000	1800000UJ	60000UJ	18000UJ	9100UJ	3800UJ	900U
2,4-Dinitrotoluene	1000	4000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
2,6-Dinitrotoluene	1000	4000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
2-Chloronaphthalene	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
2-Chlorophenol	280000	5200000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
2-Methylnaphthalene	--	--	--	700000UJ	2500J	7600U	17000	240J	65J
2-Methylphenol	2800000	10000000	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
2-Nitroaniline	--	--	--	1800000UJ	60000UJ	18000U	9100U	3800U	900U
2-Nitrophenol	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
3,3'-Dichlorobenzidine	2000	6000	100000	700000UJ	24000UJ	7600UJ	3800U	1600U	370U
3-Nitroaniline	--	--	--	1800000UJ	60000UJ	18000U	9100U	3800U	900U
4,6-Dinitro-2-methylphenol	--	--	--	1800000UJ	60000UJ	18000UJ	9100U	3800U	900U
4-Bromophenyl phenyl ether	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
4-Chloro-3-methylphenol	10000000	10000000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
4-Chloroaniline	230000	4200000	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
4-Chlorophenyl phenyl ether	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
4-Methylphenol	2800000	10000000	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
4-Nitroaniline	--	--	--	1800000UJ	60000UJ	18000U	9100U	3800U	900U
4-Nitrophenol	--	--	--	1800000UJ	60000UJ	18000U	9100UJ	3800U	900U
Acenaphthene	3400000	10000000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Acenaphthylene	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
Anthracene	10000000	10000000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Benzo(a)anthracene	900	4000	500000	700000UJ	24000UJ	27000	390J	550J	140J
Benzo(a)pyrene	660	660	100000	700000UJ	24000UJ	33000	520J	650J	90J

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: ECPSB2	ECPSB4	ECPSB5	GFSB1	GTFIRMB1	GTFIRMB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 12	08	02	02	02	02
				Zone*: ECPS	ECPS	ECPS	STF	GTF	GTF
				Date: 10/20/94	10/19/94	10/19/94	10/12/94	11/16/94	10/17/94
Benzo(b)fluoranthene	900	4000	50000	700000UJ	24000UJ	<u>30000J</u>	690J	1200J	250J
Benzo(g,h,i)perylene	--	--	--	700000UJ	24000UJ	13000	3800U	210J	370U
Benzo(k)fluoranthene	900	4000	500000	700000UJ	24000UJ	<u>29000J</u>	740J	1200J	290J
Butyl benzyl phthalate	1100000	10000000	100000	700000UJ	24000UJ	7600U	3800U	220J	370U
Carbazole	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
Chrysene	9000	40000	500000	700000UJ	6100J	29000	3800U	960J	170J
Di-n-butyl phthalate	5700000	10000000	100000	700000UJ	24000UJ	7600U	3800U	1600U	62J
Di-n-octyl phthalate	1100000	10000000	100000	700000UJ	24000UJ	7600U	3800U	1600UJ	370U
Dibenzo(a,h)anthracene	660	660	100000	700000UJ	24000UJ	<u>21000</u>	3800U	1600UJ	370U
Dibenzofuran	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
Diethyl phthalate	10000000	10000000	50000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Dimethyl phthalate	10000000	10000000	50000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Fluoranthene	2300000	10000000	100000	700000UJ	24000UJ	840J	600J	1000J	180J
Fluorene	2300000	10000000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Hexachlorobenzene	660	2000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Hexachlorobutadiene	1000	21000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Hexachlorocyclopentadiene	400000	7300000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Hexachloroethane	6000	100000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Indeno(1,2,3-cd)pyrene	900	4000	500000	700000UJ	24000UJ	<u>13000</u>	3800U	310J	370U
Isophorone	1100000	10000000	50000	700000UJ	24000UJ	7600U	3800U	1600U	370U
N-Nitroso-di-n-propylamine	660	660	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
N-Nitrosodiphenylamine	140000	600000	100000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Naphthalene	230000	4200000	100000	240000J	24000UJ	7600U	2500J	1600U	48J
Nitrobenzene	28000	520000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Pentachlorophenol	6000	24000	100000	1800000UJ	60000UJ	18000U	9100UJ	3800UJ	900U
Phenanthrene	--	--	--	700000UJ	4600J	990J	2000J	270J	120J
Phenol	10000000	10000000	50000	700000UJ	24000UJ	7600U	3800U	1600U	370U
Pyrene	1700000	10000000	100000	700000UJ	3800J	4300J	3200J	1800J	180J
bis(2-Chloroethoxy)methane	--	--	--	700000UJ	24000UJ	7600U	3800U	1600U	370U
bis(2-Chloroethyl)ether	660	3000	10000	700000UJ	24000UJ	7600U	3800U	1600U	370U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	700000UJ	24000UJ	7600U	490J	1600UJ	1200
Total Semivolatile Compounds				5180000	17000	201950	28130	8610	2775

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB3	GTFIRMB4	GTFIRMB5	GTFIRMB6	GTFIRMB7
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	06	04	02
				Zone **: GTF	GTF	GTF	GTF	GTF
				Date: 11/16/94	10/17/94	11/16/94	11/16/94	10/17/94
1,2,4-Trichlorobenzene	68000	1200000	100000	1900U	390U	4000U	4100U	370U
1,2-Dichlorobenzene	5100000	10000000	50000	1900U	390U	4000U	4100U	370U
1,3-Dichlorobenzene	5100000	10000000	100000	1900U	390U	4000U	4100U	370U
1,4-Dichlorobenzene	570000	10000000	100000	1900U	390U	4000U	4100U	370U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	1900U	390U	4000U	4100U	370U
2,4,5-Trichlorophenol	5600000	10000000	50000	4500U	950U	9600U	10000U	900U
2,4,6-Trichlorophenol	62000	270000	10000	1900U	390U	4000U	4100U	370U
2,4-Dichlorophenol	170000	3100000	10000	1900U	390U	4000U	4100U	370U
2,4-Dimethylphenol	1100000	10000000	10000	1900U	390U	4000U	4100U	370U
2,4-Dinitrophenol	110000	2100000	10000	4500UJ	950U	9600UJ	10000UJ	900U
2,4-Dinitrotoluene	1000	4000	10000	1900U	390U	4000U	4100U	370U
2,6-Dinitrotoluene	1000	4000	10000	1900U	390U	4000U	4100U	370U
2-Chloronaphthalene	--	--	--	1900U	390U	4000U	4100U	370U
2-Chlorophenol	280000	5200000	10000	1900U	390U	4000U	4100U	370U
2-Methylnaphthalene	--	--	--	1900U	160J	4000U	28000	370U
2-Methylphenol	2800000	10000000	--	1900U	390U	4000U	4100U	370U
2-Nitroaniline	--	--	--	4500U	950U	9600U	10000U	900U
2-Nitrophenol	--	--	--	1900U	390U	4000U	4100U	370U
3,3'-Dichlorobenzidine	2000	6000	100000	1900U	390U	4000U	4100U	370U
3-Nitroaniline	--	--	--	4500U	950U	9600U	10000U	900U
4,6-Dinitro-2-methylphenol	--	--	--	4500U	950U	9600U	10000U	900U
4-Bromophenyl phenyl ether	--	--	--	1900U	390U	4000U	4100U	370U
4-Chloro-3-methylphenol	10000000	10000000	100000	1900U	390U	4000U	4100U	370U
4-Chloroaniline	230000	4200000	--	1900U	390U	4000U	4100U	370U
4-Chlorophenyl phenyl ether	--	--	--	1900U	390U	4000U	4100U	370U
4-Methylphenol	2800000	10000000	--	1900U	390U	4000U	4100U	370U
4-Nitroaniline	--	--	--	4500U	950U	9600UJ	10000U	900U
4-Nitrophenol	--	--	--	4500U	950U	9600U	10000U	900U
Acenaphthene	3400000	10000000	100000	1900U	390U	4000U	4100U	370U
Acenaphthylene	--	--	--	1900U	390U	4000U	4100U	370U
Anthracene	10000000	10000000	100000	2500	1300	4000U	4100U	50J
Benzo(a)anthracene	900	4000	500000	560J	210J	520J	850J	550
Benzo(a)pyrene	660	660	100000	720J	190J	1100J	670J	430J

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB3	GTFIRMB4	GTFIRMB5	GTFIRMB6	GTFIRMB7
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	06	04	02
				Zone **: GTF	GTF	GTF	GTF	GTF
				Date: 11/16/94	10/17/94	11/16/94	11/16/94	10/17/94
Benzo(b)fluoranthene	900	4000	50000	690J	420J	1100J	2800J	1200J
Benzo(g,h,i)perylene	--	--	--	1900UJ	390UJ	4000UJ	4100UJ	370UJ
Benzo(k)fluoranthene	900	4000	500000	350J	480J	1100J	1900J	1400J
Butyl benzyl phthalate	1100000	10000000	100000	1900U	390U	4000UJ	4100UJ	370U
Carbazole	--	--	--	510J	270J	4000U	4100U	370U
Chrysene	9000	40000	500000	970J	380J	600J	1500J	510
Di-n-butyl phthalate	5700000	10000000	100000	1900U	410	4000U	4100U	93J
Di-n-octyl phthalate	1100000	10000000	100000	1900UJ	390UJ	4000UJ	4100UJ	370UJ
Dibenzo(a,h)anthracene	660	660	100000	1900UJ	390UJ	4000U	4100UJ	73J
Dibenzofuran	--	--	--	1900U	47J	4000U	4100U	370U
Diethyl phthalate	10000000	10000000	50000	1900U	390U	4000U	4100U	370U
Dimethyl phthalate	10000000	10000000	50000	1900U	390U	4000U	4100U	370U
Fluoranthene	2300000	10000000	100000	810J	340J	420J	960J	700
Fluorene	2300000	10000000	100000	1900U	71J	4000U	4100U	370U
Hexachlorobenzene	660	2000	100000	1900U	390U	4000U	4100U	370U
Hexachlorobutadiene	1000	21000	100000	1900U	390U	4000U	4100U	370U
Hexachlorocyclopentadiene	400000	7300000	100000	1900U	390U	4000U	4100U	370U
Hexachloroethane	6000	100000	100000	1900U	390U	4000U	4100U	370U
Indeno(1,2,3-cd)pyrene	900	4000	500000	1900UJ	390UJ	4000U	4100UJ	190J
Isophorone	1100000	10000000	50000	1900U	390U	4000U	4100U	370U
N-Nitroso-di-n-propylamine	660	660	10000	1900U	390U	4000U	4100U	370U
N-Nitrosodiphenylamine	140000	600000	100000	1900U	390U	4000U	4100U	370U
Naphthalene	230000	4200000	100000	1900U	92J	4000U	9700	45J
Nitrobenzene	28000	520000	10000	1900U	390U	4000U	4100U	370U
Pentachlorophenol	6000	24000	100000	4500U	950U	9600UJ	10000UJ	900U
Phenanthrene	--	--	--	780J	350J	560J	1500J	230J
Phenol	10000000	10000000	50000	1900U	390U	4000U	4100U	370U
Pyrene	1700000	10000000	100000	880J	380J	1100J	1400J	700
bis(2-Chloroethoxy)methane	--	--	--	1900U	390U	4000U	4100U	370U
bis(2-Chloroethyl)ether	660	3000	10000	1900U	390U	4000U	4100U	370U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	1900U	540	860J	4100UJ	320J
Total Semivolatile Compounds				8770	5640	7360	47080	6491

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB8	GTFIRMB8	GTFIRMB9	GTFSB1	GTFSB1	GTFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	08	02	02	08	02
				Zone **: GTF	GTF	GTF	GTF	GTF	GTF
				Date: 10/18/94	10/18/94	11/18/94	11/18/94	10/10/94	10/13/94
1,2,4-Trichlorobenzene	68000	1200000	100000	370U	12000UJ	R	R	14000U	400U
1,2-Dichlorobenzene	5100000	10000000	50000	370U	12000UJ	R	R	14000U	400U
1,3-Dichlorobenzene	5100000	10000000	100000	370U	12000UJ	R	R	14000U	400U
1,4-Dichlorobenzene	570000	10000000	100000	370U	12000UJ	R	R	14000U	400U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	370U	12000UJ	R	R	14000UJ	400UJ
2,4,5-Trichlorophenol	5600000	10000000	50000	910U	30000UJ	R	R	35000U	980U
2,4,6-Trichlorophenol	62000	270000	10000	370U	12000UJ	R	R	14000U	400U
2,4-Dichlorophenol	170000	3100000	10000	370U	12000UJ	R	R	14000U	400U
2,4-Dimethylphenol	1100000	10000000	10000	370U	12000UJ	R	R	14000U	400U
2,4-Dinitrophenol	110000	2100000	10000	910U	30000UJ	R	R	35000UJ	980UJ
2,4-Dinitrotoluene	1000	4000	10000	370U	12000UJ	R	R	14000U	400U
2,6-Dinitrotoluene	1000	4000	10000	370U	12000UJ	R	R	14000U	400U
2-Chloronaphthalene	--	--	--	370U	12000UJ	R	R	14000U	400U
2-Chlorophenol	280000	5200000	10000	370U	12000UJ	R	R	14000U	400U
2-Methylnaphthalene	--	--	--	370U	12000UJ	R	R	14000U	59J
2-Methylphenol	2800000	10000000	--	370U	12000UJ	R	R	14000U	400U
2-Nitroaniline	--	--	--	910U	30000UJ	R	R	35000U	980U
2-Nitrophenol	--	--	--	370UJ	12000UJ	R	R	14000U	400U
3,3'-Dichlorobenzidine	2000	6000	100000	370UJ	12000UJ	R	R	14000U	400UJ
3-Nitroaniline	--	--	--	910UJ	30000UJ	R	R	35000U	980U
4,6-Dinitro-2-methylphenol	--	--	--	910UJ	30000UJ	R	R	35000U	980U
4-Bromophenyl phenyl ether	--	--	--	370U	12000UJ	R	R	14000U	400U
4-Chloro-3-methylphenol	10000000	10000000	100000	370U	12000UJ	R	R	14000U	400U
4-Chloroaniline	230000	4200000	--	370UJ	12000UJ	R	R	14000U	400U
4-Chlorophenyl phenyl ether	--	--	--	370U	12000UJ	R	R	14000U	400U
4-Methylphenol	2800000	10000000	--	370U	12000UJ	R	R	14000U	400U
4-Nitroaniline	--	--	--	910U	30000UJ	R	R	35000U	980U
4-Nitrophenol	--	--	--	910U	1600J	R	R	35000UJ	980UJ
Acenaphthene	3400000	10000000	100000	370U	12000UJ	R	R	14000U	400U
Acenaphthylene	--	--	--	370U	12000UJ	R	R	14000U	400U
Anthracene	10000000	10000000	100000	370U	12000UJ	R	R	14000U	400U
Benzo(a)anthracene	900	4000	500000	430J	12000UJ	R	R	1500J	300J
Benzo(a)pyrene	660	660	100000	810J	12000UJ	R	R	14000UJ	320J

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB8	GTFIRMB8	GTFIRMB9	GTFSB1	GTFSB1	GTFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	08	02	02	08	02
				Zone **: GTF	GTF	GTF	GTF	GTF	GTF
				Date: 10/18/94	10/18/94	11/16/94	11/16/94	10/10/94	10/13/94
Benzo(b)fluoranthene	900	4000	50000	790J	12000UJ	R	R	14000UJ	730J
Benzo(g,h,i)perylene	--	--	--	420J	12000UJ	R	R	14000UJ	R
Benzo(k)fluoranthene	900	4000	500000	910J	12000UJ	R	R	14000UJ	840J
Butyl benzyl phthalate	1100000	10000000	100000	370UJ	12000UJ	R	R	14000U	400UJ
Carbazole	--	--	--	370U	12000UJ	R	R	14000U	400U
Chrysene	9000	40000	500000	780J	12000UJ	R	R	2000J	320J
Di-n-butyl phthalate	5700000	10000000	100000	370U	12000UJ	R	R	14000U	400U
Di-n-octyl phthalate	1100000	10000000	100000	370UJ	12000UJ	R	R	14000UJ	R
Dibenzo(a,h)anthracene	660	660	100000	340J	12000UJ	R	R	14000UJ	R
Dibenzofuran	--	--	--	370U	12000UJ	R	R	14000U	400U
Diethyl phthalate	10000000	10000000	50000	370U	12000UJ	R	R	14000U	400U
Dimethyl phthalate	10000000	10000000	50000	370U	12000UJ	R	R	14000U	400U
Fluoranthene	2300000	10000000	100000	210J	12000UJ	R	R	14000U	380J
Fluorene	2300000	10000000	100000	370UJ	12000UJ	R	R	14000U	400U
Hexachlorobenzene	660	2000	100000	370U	12000UJ	R	R	14000U	400U
Hexachlorobutadiene	1000	21000	100000	370U	12000UJ	R	R	14000U	400U
Hexachlorocyclopentadiene	400000	7300000	100000	370U	12000UJ	R	R	14000U	400U
Hexachloroethane	6000	100000	100000	370U	12000UJ	R	R	14000U	400U
Indeno(1,2,3-cd)pyrene	900	4000	500000	270J	12000UJ	R	R	14000UJ	140J
Isophorone	1100000	10000000	50000	370U	12000UJ	R	R	14000U	400U
N-Nitroso-di-n-propylamine	660	660	10000	370U	12000UJ	R	R	14000U	400U
N-Nitrosodiphenylamine	140000	600000	100000	360J	12000UJ	R	R	14000U	400U
Naphthalene	230000	4200000	100000	84J	12000UJ	R	R	14000U	77J
Nitrobenzene	28000	520000	10000	370U	12000UJ	R	R	14000U	400U
Pentachlorophenol	6000	24000	100000	910U	9200J	R	R	35000UJ	980UJ
Phenanthrene	--	--	--	180J	12000UJ	R	R	14000U	190J
Phenol	10000000	10000000	50000	370U	12000UJ	R	R	14000U	400U
Pyrene	1700000	10000000	100000	550	12000UJ	R	R	4200J	650J
bis(2-Chloroethoxy)methane	--	--	--	370U	12000UJ	R	R	14000U	400U
bis(2-Chloroethyl)ether	660	3000	10000	370U	12000UJ	R	R	14000U	400U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	510J	12000UJ	R	R	14000U	250J
Total Semivolatile Compounds				6644	10800	0	0	7700	4256

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB3	GTFSB4	GTFSB5	GTFSB6	GTFSB7	GTFSB7
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	02	02	02	08
				Zone **: GTF	GTF	GTF	GTF	GTF	GTF
				Date: 11/16/94	10/13/94	10/13/94	10/11/94	10/13/94	10/13/94
1,2,4-Trichlorobenzene	68000	1200000	100000	1100U	370U	350U	370U	1900U	4500U
1,2-Dichlorobenzene	5100000	10000000	50000	1100U	370U	350U	370U	1900U	4500U
1,3-Dichlorobenzene	5100000	10000000	100000	1100U	370U	350U	370U	1900U	4500U
1,4-Dichlorobenzene	570000	10000000	100000	1100U	370U	350U	370U	1900U	4500U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	1100U	370UJ	350UJ	370UJ	1900UJ	4500UJ
2,4,5-Trichlorophenol	5600000	10000000	50000	2600U	900U	860U	900U	4600U	11000U
2,4,6-Trichlorophenol	62000	270000	10000	1100U	370U	350U	370U	1900U	4500U
2,4-Dichlorophenol	170000	3100000	10000	1100U	370U	350U	370U	1900U	4500U
2,4-Dimethylphenol	1100000	10000000	10000	1100U	370U	350U	370U	1900U	4500U
2,4-Dinitrophenol	110000	2100000	10000	2600UJ	900UJ	860UJ	900UJ	4600UJ	11000UJ
2,4-Dinitrotoluene	1000	4000	10000	1100U	370U	350U	370U	1900U	4500U
2,6-Dinitrotoluene	1000	4000	10000	1100U	370U	350U	370U	1900U	4500U
2-Chloronaphthalene	--	--	--	1100U	370U	350U	370U	1900U	4500U
2-Chlorophenol	280000	5200000	10000	1100U	370U	350U	370U	1900U	4500U
2-Methylnaphthalene	--	--	--	1100U	140J	350U	370U	200J	4500U
2-Methylphenol	2800000	10000000	--	1100U	370U	350U	370U	1900U	4500U
2-Nitroaniline	--	--	--	2600U	900U	860U	900U	4600U	11000U
2-Nitrophenol	--	--	--	1100U	370U	350U	370U	1900U	4500U
3,3'-Dichlorobenzidine	2000	6000	100000	1100U	370UJ	350U	370UJ	1900U	4500UJ
3-Nitroaniline	--	--	--	2600U	900U	860U	900U	4600U	11000U
4,6-Dinitro-2-methylphenol	--	--	--	2600U	900U	860U	900U	4600U	11000U
4-Bromophenyl phenyl ether	--	--	--	1100U	370U	350U	370U	1900U	4500U
4-Chloro-3-methylphenol	10000000	10000000	100000	1100U	370U	350U	370U	1900U	4500U
4-Chloroaniline	230000	4200000	--	1100U	370U	350U	370U	1900U	4500U
4-Chlorophenyl phenyl ether	--	--	--	1100U	370U	350U	370U	1900U	4500U
4-Methylphenol	2800000	10000000	--	1100U	370U	350U	370U	1900U	4500U
4-Nitroaniline	--	--	--	2600U	900U	860U	900U	4600U	11000U
4-Nitrophenol	--	--	--	2600U	900UJ	860UJ	900UJ	4600UJ	11000UJ
Acenaphthene	3400000	10000000	100000	1100U	370U	350U	370U	1900U	4500U
Acenaphthylene	--	--	--	1100U	370U	350U	370U	1900U	4500U
Anthracene	10000000	10000000	100000	1100U	44J	350U	370U	1900U	1300J
Benzo(a)anthracene	900	4000	500000	1100U	230J	350U	430J	1900U	840J
Benzo(a)pyrene	660	660	100000	220J	240J	350U	160J	1900UJ	4500UJ

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB3	GTFSB4	GTFSB5	GTFSB6	GTFSB7	GTFSB7
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	02	02	02	08
				Zone*: GTF	GTF	GTF	GTF	GTF	GTF
				Date: 11/16/94	10/13/94	10/13/94	10/11/94	10/13/94	10/13/94
Benzo(b)fluoranthene	900	4000	50000	810J	390J	88J	710J	1900UJ	4500UJ
Benzo(g,h,i)perylene	--	--	--	1100UJ	R	350U	370UJ	1900UJ	4500UJ
Benzo(k)fluoranthene	900	4000	500000	800J	430J	99J	730J	1900UJ	4500UJ
Butyl benzyl phthalate	1100000	10000000	100000	1100UJ	370UJ	350U	370UJ	1900U	4500UJ
Carbazole	--	--	--	1100U	370U	350U	370U	1900U	4500U
Chrysene	9000	40000	500000	450J	260J	350U	390J	1900U	2700J
Di-n-butyl phthalate	5700000	10000000	100000	1100U	370U	350U	370U	1900U	4500U
Di-n-octyl phthalate	1100000	10000000	100000	1100UJ	R	350U	370UJ	1900UJ	4500UJ
Dibenzo(a,h)anthracene	660	660	100000	1100UJ	R	350U	370UJ	1900UJ	4500UJ
Dibenzofuran	--	--	--	1100U	370U	350U	370U	1900U	4500U
Diethyl phthalate	10000000	10000000	50000	1100U	370U	350U	370U	1900U	4500U
Dimethyl phthalate	10000000	10000000	50000	1100U	370U	350U	370U	1900U	4500U
Fluoranthene	2300000	10000000	100000	670J	250J	350U	200J	280J	900J
Fluorene	2300000	10000000	100000	1100U	370U	350U	370U	1900U	4500U
Hexachlorobenzene	660	2000	100000	1100U	370U	350U	370U	1900U	4500U
Hexachlorobutadiene	1000	21000	100000	1100U	370U	350U	370U	1900U	4500U
Hexachlorocyclopentadiene	400000	7300000	100000	1100U	370U	350U	370U	1900U	4500U
Hexachloroethane	8000	100000	100000	1100U	370U	350U	370U	1900U	4500U
Indeno(1,2,3-cd)pyrene	900	4000	500000	1100UJ	53J	350U	87J	1900UJ	4500UJ
Isophorone	1100000	10000000	50000	1100U	370U	350U	370U	1900U	4500U
N-Nitroso-di-n-propylamine	660	660	10000	1100U	370U	350U	370U	1900U	4500U
N-Nitrosodiphenylamine	140000	600000	100000	1100U	370U	350U	370U	1900U	4500U
Naphthalene	230000	4200000	100000	1100U	90J	350U	370U	1900U	4500U
Nitrobenzene	28000	520000	10000	1100U	370U	350U	370U	1900U	4500U
Pentachlorophenol	6000	24000	100000	2600UJ	900UJ	860UJ	900UJ	4600UJ	11000UJ
Phenanthrene	--	--	--	250J	230J	350U	69J	1900U	4100J
Phenol	10000000	10000000	50000	1100U	370U	350U	370U	1900U	4500U
Pyrene	1700000	10000000	100000	790J	610J	54J	470J	100J	3500J
bis(2-Chloroethoxy)methane	--	--	--	1100U	370U	350U	370U	1900U	4500U
bis(2-Chloroethyl)ether	660	3000	10000	1100U	370U	350U	370U	1900U	4500U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	2300J	430J	120J	370UJ	720J	4500UJ
Total Semivolatile Compounds				6290	3397	361	3246	1300	13340

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB8	GTFSB8	GTFSB9	GTFSB9	LAIRMB1	LOSB1
	Residential	Non-Residential	Impact to Groundwater	Depth: 04	08	02	08	02	04
				Zone **: GTF	GTF	GTF	GTF	LO	LO
				Date: 10/13/94	10/13/94	10/13/94	11/18/94	10/24/94	10/25/94
1,2,4-Trichlorobenzene	88000	1200000	100000	3800U	12000UJ	350U	11000UJ	870U	7600U
1,2-Dichlorobenzene	5100000	10000000	50000	3800U	12000UJ	350U	11000UJ	870U	7600U
1,3-Dichlorobenzene	5100000	10000000	100000	3800U	12000UJ	350U	11000UJ	870U	7600U
1,4-Dichlorobenzene	570000	10000000	100000	3800U	12000UJ	350U	11000UJ	870U	7600U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	3800U	12000UJ	350U	11000UJ	870U	7600U
2,4,5-Trichlorophenol	5600000	10000000	50000	9100U	29000UJ	860U	28000UJ	2100U	18000U
2,4,6-Trichlorophenol	62000	270000	10000	3800U	12000UJ	350U	11000UJ	870U	7600U
2,4-Dichlorophenol	170000	3100000	10000	3800U	12000UJ	350U	11000UJ	870U	7600U
2,4-Dimethylphenol	1100000	10000000	10000	3800U	12000UJ	350U	11000UJ	870U	7600UJ
2,4-Dinitrophenol	110000	2100000	10000	9100U	29000UJ	860U	28000UJ	2100U	18000U
2,4-Dinitrotoluene	1000	4000	10000	3800U	12000UJ	350U	11000UJ	870U	7600U
2,6-Dinitrotoluene	1000	4000	10000	3800U	12000UJ	350U	11000UJ	870U	7600U
2-Chloronaphthalene	--	--	--	3800U	12000UJ	350U	11000UJ	870U	7600U
2-Chlorophenol	280000	5200000	10000	3800U	12000UJ	350U	11000UJ	870U	7600U
2-Methylnaphthalene	--	--	--	400J	110000J	150J	56000J	870U	2000J
2-Methylphenol	2800000	10000000	--	3800U	12000UJ	350U	11000UJ	870U	7600U
2-Nitroaniline	--	--	--	9100U	29000UJ	860U	28000UJ	2100U	18000UJ
2-Nitrophenol	--	--	--	3800U	12000UJ	350U	11000UJ	870U	7600U
3,3'-Dichlorobenzidine	2000	6000	100000	3800U	12000UJ	350UJ	11000UJ	870UJ	7600UJ
3-Nitroaniline	--	--	--	9100U	29000UJ	860U	28000UJ	2100U	18000U
4,6-Dinitro-2-methylphenol	--	--	--	9100U	29000UJ	860U	28000UJ	2100U	18000U
4-Bromophenyl phenyl ether	--	--	--	3800U	12000UJ	350U	11000UJ	870U	7600U
4-Chloro-3-methylphenol	10000000	10000000	100000	3800U	12000UJ	350U	11000UJ	870U	7600U
4-Chloroaniline	230000	4200000	--	3800U	12000UJ	350U	11000UJ	870UJ	7600UJ
4-Chlorophenyl phenyl ether	--	--	--	3800U	12000UJ	350U	11000UJ	870U	7600U
4-Methylphenol	2800000	10000000	--	3800U	12000UJ	350U	11000UJ	870U	7600U
4-Nitroaniline	--	--	--	9100U	29000UJ	860U	28000UJ	2100U	18000U
4-Nitrophenol	--	--	--	9100U	29000UJ	860U	28000UJ	2100U	18000UJ
Acenaphthene	3400000	10000000	100000	3800U	11000J	350U	4500J	130J	7600U
Acenaphthylene	--	--	--	3800U	12000UJ	350U	11000UJ	180J	7600U
Anthracene	10000000	10000000	100000	3800U	12000UJ	57J	11000UJ	150J	7600U
Benzo(a)anthracene	900	4000	500000	3800U	1500J	290J	1800J	1800	14000
Benzo(a)pyrene	660	660	100000	3800U	12000UJ	220J	11000UJ	1900	1400J

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB8	GTFSB8	GTFSB9	GTFSB9	LAIRMB1	LOSB1
	Residential	Non-Residential	Impact to Groundwater	Depth: 04	08	02	08	02	04
				Zone*: GTF	GTF	GTF	GTF	LO	LO
				Date: 10/13/94	10/13/94	10/13/94	11/16/94	10/24/94	10/25/94
Benzo(b)fluoranthene	900	4000	50000	3800U	2600J	240J	2700J	3300J	6400J
Benzo(g,h,i)perylene	--	--	--	3800U	12000UJ	R	11000UJ	390J	2300J
Benzo(k)fluoranthene	900	4000	500000	3800U	2800J	420J	2800J	1400J	7000J
Butyl benzyl phthalate	1100000	10000000	100000	3800U	12000UJ	350UJ	11000UJ	870U	7800U
Carbazole	--	--	--	3800U	12000UJ	350U	11000UJ	870U	7800U
Chrysene	9000	40000	500000	1200J	6400J	510J	4800J	1900	22000
Di-n-butyl phthalate	5700000	10000000	100000	3800U	12000UJ	350U	11000UJ	870U	7800U
Di-n-octyl phthalate	1100000	10000000	100000	3800U	12000UJ	R	11000UJ	870U	7800U
Dibenzo(a,h)anthracene	660	660	100000	3800U	12000UJ	R	11000UJ	270J	1800J
Dibenzofuran	--	--	--	3800U	12000UJ	350U	11000UJ	870U	7800U
Diethyl phthalate	10000000	10000000	50000	3800U	12000UJ	350U	11000UJ	870U	7800U
Dimethyl phthalate	10000000	10000000	50000	3800U	12000UJ	350U	11000UJ	870U	7800U
Fluoranthene	2300000	10000000	100000	3800U	2300J	240J	2100J	2600	1800J
Fluorene	2300000	10000000	100000	3800U	17000J	350U	5800J	870U	7800U
Hexachlorobenzene	660	2000	100000	3800U	12000UJ	350U	11000UJ	870U	7800U
Hexachlorobutadiene	1000	21000	100000	3800U	12000UJ	350U	11000UJ	870U	7800U
Hexachlorocyclopentadiene	400000	7300000	100000	3800U	12000UJ	350U	11000UJ	870U	7800U
Hexachloroethane	6000	100000	100000	3800U	12000UJ	350U	11000UJ	870U	7800U
Indeno(1,2,3-cd)pyrene	900	4000	500000	3800U	12000UJ	R	11000UJ	690J	1300J
Isophorone	1100000	10000000	50000	3800U	12000UJ	350U	11000UJ	870U	7800U
N-Nitroso-di-n-propylamine	660	660	10000	3800U	12000UJ	350U	11000UJ	870U	7800U
N-Nitrosodiphenylamine	140000	600000	100000	3800U	12000UJ	350U	11000UJ	870UJ	7800U
Naphthalene	230000	4200000	100000	3800U	24000J	350U	13000J	870U	7800U
Nitrobenzene	28000	520000	10000	3800U	12000UJ	350U	11000UJ	870U	7800U
Pentachlorophenol	6000	24000	100000	9100U	29000UJ	860U	28000UJ	R	18000U
Phenanthrene	--	--	--	3800U	45000J	340J	9600J	430J	2400J
Phenol	10000000	10000000	50000	3800U	12000UJ	350U	11000UJ	870U	7800U
Pyrene	1700000	10000000	100000	3800U	15000J	500J	5700J	2400	10000
bis(2-Chloroethoxy)methane	--	--	--	3800U	12000UJ	350U	11000UJ	870U	7800U
bis(2-Chloroethyl)ether	660	3000	10000	3800U	12000UJ	350U	11000UJ	870U	7800U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	3800U	12000UJ	200J	2300J	870U	7800U
Total Semivolatile Compounds				1600	237600	3167	111100	17540	72200

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB1	LOS82	LOS82	LOS83	LOS84	LOS84	LOS88
	Residential	Non-Residential	Impact to Groundwater	Depth: 08	04	08	02	02	06	02
				Zone **: LO	LO	LO	LO	LO	LO	SS
				Date: 10/25/94	11/16/94	10/14/94	10/24/94	10/24/94	10/24/94	10/24/94
1,2,4-Trichlorobenzene	68000	1200000	100000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
1,2-Dichlorobenzene	5100000	10000000	50000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
1,3-Dichlorobenzene	5100000	10000000	100000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
1,4-Dichlorobenzene	570000	10000000	100000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	1900U	29000UJ	60000UJ	2000U	8200U	11000U	58000U
2,4,5-Trichlorophenol	5600000	10000000	50000	4500U	71000UJ	150000U	4900U	20000U	27000U	150000U
2,4,6-Trichlorophenol	62000	270000	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2,4-Dichlorophenol	170000	3100000	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2,4-Dimethylphenol	1100000	10000000	10000	1900UJ	29000UJ	60000U	2000U	8200U	11000U	58000U
2,4-Dinitrophenol	110000	2100000	10000	4500U	71000UJ	150000UJ	4900U	20000UJ	27000UJ	150000UJ
2,4-Dinitrotoluene	1000	4000	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2,6-Dinitrotoluene	1000	4000	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2-Chloronaphthalene	--	--	--	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2-Chlorophenol	280000	5200000	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2-Methylnaphthalene	--	--	--	8000	120000J	60000U	2000U	8200U	11000U	58000U
2-Methylphenol	2800000	10000000	--	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
2-Nitroaniline	--	--	--	4500UJ	71000UJ	150000U	4900U	20000U	27000U	150000U
2-Nitrophenol	--	--	--	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
3,3'-Dichlorobenzidine	2000	6000	100000	1900UJ	29000UJ	60000U	2000UJ	8200U	11000U	58000U
3-Nitroaniline	--	--	--	4500U	71000UJ	150000U	4900U	20000U	27000U	150000U
4,6-Dinitro-2-methylphenol	--	--	--	4500UJ	71000UJ	150000U	4900U	20000U	27000U	150000U
4-Bromophenyl phenyl ether	--	--	--	1900UJ	29000UJ	60000U	2000U	8200U	11000U	58000U
4-Chloro-3-methylphenol	10000000	10000000	100000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
4-Chloroaniline	230000	4200000	--	1900UJ	29000UJ	60000U	2000U	8200UJ	11000UJ	58000UJ
4-Chlorophenyl phenyl ether	--	--	--	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
4-Methylphenol	2800000	10000000	--	210J	29000UJ	60000U	2000U	8200U	11000U	58000U
4-Nitroaniline	--	--	--	4500U	71000UJ	150000U	4900U	20000U	27000U	150000U
4-Nitrophenol	--	--	--	4500UJ	71000UJ	150000UJ	4900U	20000UJ	27000UJ	150000UJ
Acenaphthene	3400000	10000000	100000	720J	29000UJ	60000U	2000U	8200U	11000U	58000U
Acenaphthylene	--	--	--	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Anthracene	10000000	10000000	100000	1300J	29000UJ	60000U	2000U	8200U	11000U	58000U
Benzo(a)anthracene	900	4000	500000	15000J	29000UJ	52000J	2000U	8200U	11000U	58000U
Benzo(a)pyrene	660	660	100000	26000J	3300J	37000J	2000U	8200U	11000U	58000U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB1	LOSB2	LOSB2	LOSB3	LOSB4	LOSB4	LOSB8
	Residential	Non-Residential	Impact to Groundwater	Depth: 08	04	08	02	02	06	02
				Zone **: LO	LO	LO	LO	LO	LO	LO
				Date: 10/25/94	11/16/94	10/14/94	10/24/94	10/24/94	10/24/94	10/24/94
Benzo(b)fluoranthene	900	4000	50000	<u>14000J</u>	<u>8800J</u>	<u>28000J</u>	2000U	8200U	11000U	58000U
Benzo(g,h,i)perylene	--	--	--	10000J	29000UJ	80000UJ	2000U	8200U	11000U	58000U
Benzo(k)fluoranthene	900	4000	500000	<u>14000J</u>	<u>8800J</u>	<u>27000J</u>	2000U	8200U	11000U	58000U
Butyl benzyl phthalate	1100000	10000000	100000	1900UJ	29000UJ	60000U	2000U	8200U	11000U	58000U
Carbazole	--	--	--	1900UJ	29000UJ	60000U	2000U	8200U	11000U	58000U
Chrysene	9000	40000	500000	23000J	15000J	<u>97000</u>	2000U	8200U	11000U	58000U
Di-n-butyl phthalate	5700000	10000000	100000	1900UJ	29000UJ	60000U	2000U	8200U	11000U	58000U
Di-n-octyl phthalate	1100000	10000000	100000	1900UJ	29000UJ	60000UJ	2000U	8200UJ	11000UJ	58000UJ
Dibenzo(a,h)anthracene	880	880	100000	<u>10000J</u>	29000UJ	60000UJ	2000U	8200U	11000U	58000U
Dibenzofuran	--	--	--	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Diethyl phthalate	10000000	10000000	50000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Dimethyl phthalate	10000000	10000000	50000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Fluoranthene	2300000	10000000	100000	1900J	29000UJ	9300J	2000U	8200U	11000U	58000U
Fluorene	2300000	10000000	100000	940J	29000UJ	60000U	2000U	8200U	11000U	58000U
Hexachlorobenzene	680	2000	100000	1900UJ	29000UJ	60000U	2000U	8200U	11000U	58000U
Hexachlorobutadiene	1000	21000	100000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Hexachlorocyclopentadiene	400000	7300000	100000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Hexachloroethane	8000	100000	100000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Indeno(1,2,3-cd)pyrene	900	4000	500000	<u>7600J</u>	29000UJ	60000UJ	2000U	8200U	11000U	58000U
Isophorone	1100000	10000000	50000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
N-Nitroso-di-n-propylamine	660	880	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
N-Nitrosodiphenylamine	140000	600000	100000	1900UJ	29000UJ	60000U	2000U	8200UJ	11000UJ	58000UJ
Naphthalene	230000	4200000	100000	2100	25000J	60000U	2000U	8200U	11000U	58000U
Nitrobenzene	28000	520000	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Pentachlorophenol	8000	24000	100000	4500UJ	71000UJ	150000UJ	R	20000U	27000U	150000U
Phenanthrene	--	--	--	6200J	15000J	17000J	2000U	8200U	11000U	58000U
Phenol	10000000	10000000	50000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
Pyrene	1700000	10000000	100000	9000J	8100J	89000	210J	8200U	11000U	6900J
bis(2-Chloroethoxy)methane	--	--	--	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
bis(2-Chloroethyl)ether	660	3000	10000	1900U	29000UJ	60000U	2000U	8200U	11000U	58000U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	1900UJ	29000UJ	60000U	2000U	8200U	11000U	58000U
Total Semivolatile Compounds				149970	204000	334300	210	0	0	6900

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB8	LOSB9	LOSB9	LOSB10	LOSB10	LOSB11	LOSB12
	Residential	Non-Residential	Impact to Groundwater	Depth: 08	02	06	04	08	02	02
				Zone*: LO	LO	LO	LO	LO	LO	LO
				Date: 10/24/94	10/25/94	10/25/94	10/28/94	10/28/94	10/25/94	10/25/94
1,2,4-Trichlorobenzene	68000	1200000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
1,2-Dichlorobenzene	5100000	10000000	50000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
1,3-Dichlorobenzene	5100000	10000000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
1,4-Dichlorobenzene	570000	10000000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2,4,5-Trichlorophenol	5600000	10000000	50000	18000U	15000U	56000U	28000U	53000U	5300U	5600U
2,4,6-Trichlorophenol	62000	270000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2,4-Dichlorophenol	170000	3100000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2,4-Dimethylphenol	1100000	10000000	10000	7600U	6300UJ	22000U	11000U	21000U	2200UJ	250J
2,4-Dinitrophenol	110000	2100000	10000	18000U	15000U	56000UJ	28000UJ	53000UJ	5300U	5600U
2,4-Dinitrotoluene	1000	4000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2,6-Dinitrotoluene	1000	4000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2-Chloronaphthalene	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2-Chlorophenol	280000	5200000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2-Methylnaphthalene	--	--	--	4200J	6300U	22000U	5200J	4000J	520J	330J
2-Methylphenol	2800000	10000000	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
2-Nitroaniline	--	--	--	18000U	15000UJ	56000U	28000U	53000U	5300UJ	5600U
2-Nitrophenol	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
3,3'-Dichlorobenzidine	2000	6000	100000	7600UJ	6300UJ	22000U	11000UJ	21000UJ	2200UJ	2300U
3-Nitroaniline	--	--	--	18000U	15000U	56000U	28000U	53000U	5300U	5600U
4,6-Dinitro-2-methylphenol	--	--	--	18000U	15000U	56000U	28000UJ	53000UJ	5300U	5600U
4-Bromophenyl phenyl ether	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
4-Chloro-3-methylphenol	10000000	10000000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
4-Chloroaniline	230000	4200000	--	7600UJ	6300UJ	22000UJ	11000U	21000U	2200UJ	2300U
4-Chlorophenyl phenyl ether	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
4-Methylphenol	2800000	10000000	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
4-Nitroaniline	--	--	--	18000U	15000U	56000U	28000U	53000U	5300U	5600U
4-Nitrophenol	--	--	--	18000U	15000UJ	56000U	28000U	53000U	5300UJ	5600UJ
Acenaphthene	3400000	10000000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Acenaphthylene	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Anthracene	10000000	10000000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Benzo(a)anthracene	900	4000	500000	1200J	2000J	22000U	1100J	2500J	340J	350J
Benzo(a)pyrene	660	660	100000	870J	6300U	22000U	11000U	2300J	270J	920J

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB8	LOS89	LOS89	LOS810	LOS810	LOS811	LOS812
	Residential	Non-Residential	Impact to Groundwater	Depth: 08	02	08	04	08	02	02
				Zone **: LO	LO	LO	LO	LO	LO	LO
				Date: 10/24/94	10/25/94	10/25/94	10/28/94	10/28/94	10/25/94	10/25/94
Benzo(b)fluoranthene	900	4000	50000	1200J	6300U	22000U	1400J	2200J	630J	890J
Benzo(g,h,i)perylene	--	--	--	7600U	6300U	22000U	1500J	2500J	2200U	1800J
Benzo(k)fluoranthene	900	4000	500000	1300J	6300U	22000U	1400J	2300J	620J	860J
Butyl benzyl phthalate	1100000	10000000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300UJ
Carbazole	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Chrysene	9000	40000	500000	2800J	2600J	5500J	2000J	5800J	580J	1200J
Di-n-butyl phthalate	5700000	10000000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300UJ
Di-n-octyl phthalate	1100000	10000000	100000	7600U	6300U	22000UJ	11000UJ	21000UJ	2200U	R
Dibenzo(a,h)anthracene	660	660	100000	7600U	6300U	22000U	11000UJ	21000UJ	2200U	750J
Dibenzofuran	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Diethyl phthalate	10000000	10000000	50000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Dimethyl phthalate	10000000	10000000	50000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Fluoranthene	2300000	10000000	100000	7600U	2500J	22000U	11000U	21000U	420J	2300U
Fluorene	2300000	10000000	100000	1500J	6300U	22000U	11000U	21000U	2200U	250J
Hexachlorobenzene	660	2000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Hexachlorobutadiene	1000	21000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Hexachlorocyclopentadiene	400000	7300000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300UJ
Hexachloroethane	6000	100000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Indeno(1,2,3-cd)pyrene	900	4000	500000	7600U	6300U	22000U	11000UJ	21000UJ	2200U	570J
Isophorone	1100000	10000000	50000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
N-Nitroso-di-n-propylamine	660	660	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
N-Nitrosodiphenylamine	140000	800000	100000	7600UJ	6300U	22000UJ	11000U	21000U	2200U	2300U
Naphthalene	230000	4200000	100000	7600U	6300U	22000U	11000U	21000U	2200U	300J
Nitrobenzene	28000	520000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Pentachlorophenol	6000	24000	100000	R	15000U	56000U	28000U	53000U	5300U	5600U
Phenanthrene	--	--	--	4000J	2600J	5800J	1800J	12000J	400J	2300U
Phenol	10000000	10000000	50000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
Pyrene	1700000	10000000	100000	1600J	2000J	2600J	1800J	4300J	450J	380J
bis(2-Chloroethoxy)methane	--	--	--	7600U	6300U	22000U	11000U	21000U	2200U	2300U
bis(2-Chloroethyl)ether	660	3000	10000	7600U	6300U	22000U	11000U	21000U	2200U	2300U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	7600U	6300U	22000U	11000U	21000U	2200U	2300UJ
Total Semivolatile Compounds				18670	11700	13900	16000	37900	4230	8850

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB12	LOSB13	LOSB13FR	LOSB13	LOSB14	LOSB15	LOSB16
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	02	02	08	02	02	04
				Zone **: LO	LO	LO	LO	LO	LO	LO
				Date: 10/25/94	10/31/94	10/31/94	10/31/94	10/25/94	10/24/94	10/25/94
1,2,4-Trichlorobenzene	68000	1200000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
1,2-Dichlorobenzene	5100000	10000000	50000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
1,3-Dichlorobenzene	5100000	10000000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
1,4-Dichlorobenzene	570000	10000000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2,4,5-Trichlorophenol	5600000	10000000	50000	32000U	29000U	28000U	28000U	5300U	150000U	43000U
2,4,6-Trichlorophenol	62000	270000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2,4-Dichlorophenol	170000	3100000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2,4-Dimethylphenol	1100000	10000000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2,4-Dinitrophenol	110000	2100000	10000	32000U	29000U	28000U	28000U	5300U	150000U	43000U
2,4-Dinitrotoluene	1000	4000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2,6-Dinitrotoluene	1000	4000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2-Chloronaphthalene	--	--	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2-Chlorophenol	280000	5200000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2-Methylnaphthalene	--	--	--	13000U	1400J	1200J	3000J	300J	58000U	30000
2-Methylphenol	2800000	10000000	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
2-Nitroaniline	--	--	--	32000U	29000U	28000U	28000U	5300U	150000U	43000U
2-Nitrophenol	--	--	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
3,3'-Dichlorobenzidine	2000	6000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
3-Nitroaniline	--	--	--	32000U	29000U	28000U	28000U	5300U	150000U	43000U
4,6-Dinitro-2-methylphenol	--	--	--	32000U	29000U	28000U	28000U	5300U	150000U	43000U
4-Bromophenyl phenyl ether	--	--	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
4-Chloro-3-methylphenol	10000000	10000000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
4-Chloroaniline	230000	4200000	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
4-Chlorophenyl phenyl ether	--	--	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
4-Methylphenol	2800000	10000000	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
4-Nitroaniline	--	--	--	32000U	29000U	28000U	28000U	5300U	150000U	43000U
4-Nitrophenol	--	--	--	32000U	29000U	28000U	28000U	5300U	150000U	43000U
Acenaphthene	3400000	10000000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Acenaphthylene	--	--	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Anthracene	10000000	10000000	100000	13000U	11000U	11000U	11000U	370J	58000U	17000U
Benzo(a)anthracene	900	4000	500000	13000U	11000U	11000U	11000U	870J	58000U	17000U
Benzo(a)pyrene	660	660	100000	2100J	11000U	11000U	11000U	2200U	58000U	17000U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB12	LOSB13	LOSB13FR	LOSB13	LOSB14	LOSB15	LOSB16
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	02	02	08	02	02	04
				Zone **: LO	LO	LO	LO	LO	LO	LO
				Date: 10/25/94	10/31/94	10/31/94	10/31/94	10/25/94	10/24/94	10/25/94
Benzo(b)fluoranthene	900	4000	50000	2100J	1300J	11000U	11000U	1200J	58000U	17000U
Benzo(g,h,i)perylene	--	--	--	2500J	11000U	11000UJ	11000UJ	2200U	58000U	17000UJ
Benzo(k)fluoranthene	900	4000	500000	2300J	1500J	11000U	11000U	1200J	58000U	17000U
Butyl benzyl phthalate	1100000	10000000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Carbazole	--	--	--	13000U	11000U	11000U	11000U	280J	58000U	17000U
Chrysene	9000	40000	500000	3300J	1900J	1600J	2000J	1900J	58000U	17000U
Di-n-butyl phthalate	5700000	10000000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Di-n-octyl phthalate	1100000	10000000	100000	13000U	11000U	11000UJ	11000UJ	2200U	58000UJ	17000UJ
Dibenzo(a,h)anthracene	660	660	100000	1600J	11000U	11000UJ	11000UJ	2200U	58000U	17000UJ
Dibenzofuran	--	--	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Diethyl phthalate	10000000	10000000	50000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Dimethyl phthalate	10000000	10000000	50000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Fluoranthene	2300000	10000000	100000	13000U	11000U	11000U	11000U	1300J	58000U	17000U
Fluorene	2300000	10000000	100000	13000U	11000U	11000U	11000U	270J	58000U	17000U
Hexachlorobenzene	660	2000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Hexachlorobutadiene	1000	21000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Hexachlorocyclopentadiene	400000	7300000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Hexachloroethane	6000	100000	100000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Indeno(1,2,3-cd)pyrene	900	4000	500000	1400J	11000U	11000UJ	11000UJ	2200U	58000U	17000UJ
Isophorone	1100000	10000000	50000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
N-Nitroso-di-n-propylamine	660	660	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
N-Nitrosodiphenylamine	140000	600000	100000	13000UJ	11000UJ	11000UJ	11000U	2200U	58000UJ	17000UJ
Naphthalene	230000	4200000	100000	13000U	11000U	11000U	11000U	260J	58000U	17000U
Nitrobenzene	28000	520000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Pentachlorophenol	6000	24000	100000	32000U	29000U	28000U	28000U	5300U	150000U	43000U
Phenanthrene	--	--	--	13000U	11000U	11000U	2400J	1700J	58000U	17000U
Phenol	10000000	10000000	50000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
Pyrene	1700000	10000000	100000	1400J	1600J	11000U	1700J	1400J	58000U	17000U
bis(2-Chloroethoxy)methane	--	--	--	13000U	11000U	11000U	11000U	2200U	58000U	17000U
bis(2-Chloroethyl)ether	660	3000	10000	13000U	11000U	11000U	11000U	2200U	58000U	17000U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	13000U	11000U	3500J	9300J	2200U	58000U	17000U
Total Semivolatile Compounds				16700	7700	6300	18400	11050	0	30000

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB17	LOSB18	LOSB18	LOSB18FR	MBSB1	MBSB2	MBSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	08	08	02	02	08
				Zone * **: LO	LO	LO	LO	MB	MB	MB
				Date: 10/24/94	10/24/94	10/24/94	10/24/94	10/25/94	10/21/94	10/25/94
1,2,4-Trichlorobenzene	68000	1200000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
1,2-Dichlorobenzene	5100000	10000000	50000	390U	380U	61000U	65000U	1900U	780J	9600U
1,3-Dichlorobenzene	5100000	10000000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
1,4-Dichlorobenzene	570000	10000000	100000	390U	380U	61000U	65000U	1900U	3800U	9600UJ
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
2,4,5-Trichlorophenol	5600000	10000000	50000	950U	910U	150000U	160000U	4700U	9300U	23000U
2,4,6-Trichlorophenol	62000	270000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
2,4-Dichlorophenol	170000	3100000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
2,4-Dimethylphenol	1100000	10000000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
2,4-Dinitrophenol	110000	2100000	10000	950U	910UJ	150000UJ	160000UJ	4700U	9300U	23000U
2,4-Dinitrotoluene	1000	4000	10000	390U	380U	61000U	65000U	1900U	3800U	R
2,6-Dinitrotoluene	1000	4000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
2-Chloronaphthalene	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
2-Chlorophenol	280000	5200000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
2-Methylnaphthalene	--	--	--	75J	77J	61000U	65000U	730J	490J	1200J
2-Methylphenol	2800000	10000000	--	390U	380U	61000U	65000U	1900U	3800U	9600U
2-Nitroaniline	--	--	--	950U	910U	150000U	160000U	4700U	9300U	23000U
2-Nitrophenol	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
3,3'-Dichlorobenzidine	2000	6000	100000	390UJ	380U	61000U	65000U	1900U	3800UJ	9600U
3-Nitroaniline	--	--	--	950U	910U	150000U	160000U	4700U	9300U	23000U
4,6-Dinitro-2-methylphenol	--	--	--	950U	910U	150000U	160000U	4700U	9300UJ	23000U
4-Bromophenyl phenyl ether	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
4-Chloro-3-methylphenol	10000000	10000000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
4-Chloroaniline	230000	4200000	--	390UJ	380UJ	61000UJ	65000UJ	1900U	3800U	9600U
4-Chlorophenyl phenyl ether	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
4-Methylphenol	2800000	10000000	--	390U	380U	61000U	65000U	1900U	3800U	9600U
4-Nitroaniline	--	--	--	950U	910U	150000U	160000U	4700U	9300UJ	23000U
4-Nitrophenol	--	--	--	950U	910U	150000UJ	160000UJ	4700U	9300UJ	23000U
Acenaphthene	3400000	10000000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
Acenaphthylene	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
Anthracene	10000000	10000000	100000	54J	46J	61000U	65000U	1900U	3800U	9600U
Benzo(a)anthracene	900	4000	500000	620	1100	61000U	65000U	390J	3800U	9600U
Benzo(a)pyrene	660	660	100000	1600J	1700	61000U	65000U	370J	3800U	9600U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB17	LOSB18	LOSB18	LOSB18FR	MBSB1	MBSB2	MBSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	08	08	02	02	08
				Zone*: LO	LO	LO	LO	MB	MB	MB
				Date: 10/24/94	10/24/94	10/24/94	10/24/94	10/25/94	10/21/94	10/25/94
Benzo(b)fluoranthene	900	4000	50000	1200J	1000J	61000U	65000U	650J	3800U	9600U
Benzo(g,h,i)perylene	--	--	--	1500J	1300	61000U	65000U	350J	3800U	9600U
Benzo(k)fluoranthene	900	4000	500000	1200J	1200J	61000U	65000U	600J	3800UJ	9600U
Butyl benzyl phthalate	1100000	10000000	100000	390U	380U	61000U	65000U	1900UJ	3800U	9600UJ
Carbazole	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
Chrysene	9000	40000	500000	930	1800	61000U	65000U	1100J	620J	9600U
Di-n-butyl phthalate	5700000	10000000	100000	390U	380U	61000U	65000U	1900UJ	3800U	9600UJ
Di-n-octyl phthalate	1100000	10000000	100000	390UJ	380U	61000UJ	65000UJ	1900UJ	3800U	9600UJ
Dibenzo(a,h)anthracene	660	660	100000	1100J	570	61000U	65000U	220J	3800U	9600U
Dibenzofuran	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
Diethyl phthalate	10000000	10000000	50000	390U	380U	61000U	65000U	1900U	3800U	9600U
Dimethyl phthalate	10000000	10000000	50000	390U	380U	61000U	65000U	1900U	3800U	9600U
Fluoranthene	2300000	10000000	100000	170J	160J	61000U	65000U	480J	3800U	9600U
Fluorene	2300000	10000000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
Hexachlorobenzene	660	2000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
Hexachlorobutadiene	1000	21000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
Hexachlorocyclopentadiene	400000	7300000	100000	390U	380U	61000U	65000U	1900UJ	3800U	9600UJ
Hexachloroethane	8000	100000	100000	390U	380U	61000U	65000U	1900U	3800U	9600U
Indeno(1,2,3-cd)pyrene	900	4000	500000	800J	530	61000U	65000U	230J	3800U	9600U
Isophorone	1100000	10000000	50000	390U	380U	61000U	65000U	1900U	3800U	9600U
N-Nitroso-di-n-propylamine	660	660	10000	390U	380U	61000U	65000U	1900U	3800U	R
N-Nitrosodiphenylamine	140000	600000	100000	390UJ	380UJ	61000UJ	65000UJ	1900U	3800U	9600U
Naphthalene	230000	4200000	100000	50J	72J	61000U	65000U	1900U	3800U	9600U
Nitrobenzene	28000	520000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
Pentachlorophenol	6000	24000	100000	75J	R	150000U	R	R	9300U	23000UJ
Phenanthrene	--	--	--	170J	220J	61000U	65000U	1500J	3800U	9600U
Phenol	10000000	10000000	50000	390U	380U	61000U	65000U	1900U	3800U	9600U
Pyrene	1700000	10000000	100000	390	550	61000U	65000U	1700J	3800U	2000J
bis(2-Chloroethoxy)methane	--	--	--	390U	380U	61000U	65000U	1900U	3800U	9600U
bis(2-Chloroethyl)ether	660	3000	10000	390U	380U	61000U	65000U	1900U	3800U	9600U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	670	740	61000U	65000U	1900UJ	2100J	9600UJ
Total Semivolatile Compounds				10604	11065	0	0	8320	3990	3200

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: MBSB3		MBSB3FR	MDCBSB2	N2TFSB2	N2TFSB4	N2TFSB4
	Residential	Non-Residential	Impact to Groundwater	Depth: 10	10	03	02	02	06	
				Zone **: MB	MB	MDC	N2TF	N2TF	N2TF	
				Date: 10/25/94	10/25/94	10/11/94	10/19/94	10/28/94	10/28/94	
1,2,4-Trichlorobenzene	68000	1200000	100000	43000U	69000U	360U	410U	66000U	12000U	
1,2-Dichlorobenzene	5100000	10000000	50000	43000U	69000U	360U	410U	66000U	12000U	
1,3-Dichlorobenzene	5100000	10000000	100000	43000U	69000U	360U	410U	66000U	12000U	
1,4-Dichlorobenzene	570000	10000000	100000	43000U	69000U	360U	410U	66000U	12000U	
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	43000U	69000U	360UJ	410U	66000U	12000U	
2,4,5-Trichlorophenol	5600000	10000000	50000	110000U	170000U	870U	980U	160000U	31000U	
2,4,6-Trichlorophenol	62000	270000	10000	43000U	69000U	360U	410U	66000U	12000U	
2,4-Dichlorophenol	170000	3100000	10000	43000U	69000U	360U	410U	66000U	12000U	
2,4-Dimethylphenol	1100000	10000000	10000	43000U	69000U	360U	410U	66000U	12000U	
2,4-Dinitrophenol	110000	2100000	10000	110000UJ	170000UJ	870UJ	980U	160000U	31000UJ	
2,4-Dinitrotoluene	1000	4000	10000	43000U	69000U	360U	410U	66000U	12000U	
2,6-Dinitrotoluene	1000	4000	10000	43000U	69000U	360U	410U	66000U	12000U	
2-Chloronaphthalene	--	--	--	43000U	69000U	360U	410U	66000U	12000U	
2-Chlorophenol	280000	5200000	10000	43000U	69000U	360U	410U	66000U	12000U	
2-Methylnaphthalene	--	--	--	27000J	27000J	360U	510	31000J	110000	
2-Methylphenol	2800000	10000000	--	43000U	69000U	360U	410U	66000U	12000U	
2-Nitroaniline	--	--	--	110000U	170000U	870U	980U	160000U	31000U	
2-Nitrophenol	--	--	--	43000U	69000U	360U	410UJ	66000U	12000U	
3,3'-Dichlorobenzidine	2000	6000	100000	43000U	69000U	360UJ	410UJ	66000U	12000UJ	
3-Nitroaniline	--	--	--	110000U	170000U	870U	980UJ	160000U	31000U	
4,6-Dinitro-2-methylphenol	--	--	--	110000U	170000U	870U	980UJ	160000U	31000UJ	
4-Bromophenyl phenyl ether	--	--	--	43000U	69000U	360U	410U	66000U	12000U	
4-Chloro-3-methylphenol	10000000	10000000	100000	43000U	69000U	360U	410U	66000U	12000U	
4-Chloroaniline	230000	4200000	--	43000UJ	69000UJ	360U	410UJ	66000UJ	12000U	
4-Chlorophenyl phenyl ether	--	--	--	43000U	69000U	360U	410U	66000U	12000U	
4-Methylphenol	2800000	10000000	--	43000U	69000U	360U	410U	66000U	12000U	
4-Nitroaniline	--	--	--	110000U	170000U	870U	980U	160000U	31000U	
4-Nitrophenol	--	--	--	110000U	170000U	870UJ	980U	160000U	31000U	
Acenaphthene	3400000	10000000	100000	43000U	69000U	360U	410U	66000U	12000U	
Acenaphthylene	--	--	--	43000U	69000U	360U	410U	66000U	12000U	
Anthracene	10000000	10000000	100000	43000U	69000U	360U	410U	66000U	12000U	
Benzo(a)anthracene	900	4000	500000	43000U	69000U	200J	100J	66000U	12000U	
Benzo(a)pyrene	660	660	100000	43000U	69000U	270J	45J	66000U	12000U	

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: MBSB3	MBSB3FR	MDCBSB2	N2TFSB2	N2TFSB4	N2TFSB4
	Residential	Non-Residential	Impact to Groundwater	Depth: 10	10	03	02	02	06
				Zone **: MB	MB	MDC	N2TF	N2TF	N2TF
				Date: 10/25/94	10/25/94	10/11/94	10/19/94	10/28/94	10/28/94
Benzo(b)fluoranthene	900	4000	50000	43000U	69000U	510J	170J	66000U	12000U
Benzo(g,h,i)perylene	--	--	--	43000U	69000U	R	410U	66000U	12000UJ
Benzo(k)fluoranthene	900	4000	500000	43000U	69000U	490J	190J	66000U	12000U
Butyl benzyl phthalate	1100000	10000000	100000	43000U	69000U	360UJ	410U	66000U	12000U
Carbazole	--	--	--	43000U	69000U	360U	410U	66000U	12000U
Chrysene	9000	40000	500000	4900J	69000U	230J	290J	66000U	2300J
Di-n-butyl phthalate	5700000	10000000	100000	43000U	69000U	360U	410U	66000U	12000U
Di-n-octyl phthalate	1100000	10000000	100000	43000UJ	69000UJ	47J	410U	66000U	12000UJ
Dibenzo(a,h)anthracene	660	660	100000	43000U	69000U	R	53J	66000U	12000UJ
Dibenzofuran	--	--	--	43000U	69000U	360U	410U	66000U	3100J
Diethyl phthalate	10000000	10000000	50000	43000U	69000U	360U	410U	66000U	12000U
Dimethyl phthalate	10000000	10000000	50000	43000U	69000U	360U	410U	66000U	12000U
Fluoranthene	2300000	10000000	100000	43000U	69000U	150J	62J	66000U	12000U
Fluorene	2300000	10000000	100000	43000U	69000U	360U	410UJ	6700J	12000U
Hexachlorobenzene	660	2000	100000	43000U	69000U	360U	410U	66000U	12000U
Hexachlorobutadiene	1000	21000	100000	43000U	69000U	360U	410U	66000U	12000U
Hexachlorocyclopentadiene	400000	7300000	100000	43000U	69000U	360U	410U	66000U	12000U
Hexachloroethane	6000	100000	100000	43000U	69000U	360U	410U	66000U	12000U
Indeno(1,2,3-cd)pyrene	900	4000	500000	43000U	69000U	R	410U	66000U	12000UJ
Isophorone	1100000	10000000	50000	43000U	69000U	360U	410U	66000U	12000U
N-Nitroso-di-n-propylamine	660	660	10000	43000U	69000U	360U	410U	66000U	12000U
N-Nitrosodiphenylamine	140000	600000	100000	43000UJ	69000UJ	360U	410UJ	66000UJ	12000U
Naphthalene	230000	4200000	100000	43000U	69000U	64J	410U	7300J	39000
Nitrobenzene	28000	520000	10000	43000U	69000U	360U	410U	66000U	12000U
Pentachlorophenol	6000	24000	100000	110000U	170000U	870UJ	980U	160000U	31000U
Phenanthrene	--	--	--	23000J	38000J	150J	100J	9300J	19000
Phenol	10000000	10000000	50000	43000U	69000U	360U	410U	66000U	12000U
Pyrene	1700000	10000000	100000	6400J	9800J	480J	67J	14000J	4400J
bis(2-Chloroethoxy)methane	--	--	--	43000U	69000U	360U	410U	66000U	12000U
bis(2-Chloroethyl)ether	660	3000	10000	43000U	69000U	360U	410U	66000U	12000U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	43000U	69000U	1000J	220J	66000U	2000J
Total Semivolatile Compounds				61300	74800	3591	1807	68300	179800

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N2TFSB5	N2TFSB5	N3TFSB1	N3TFSB2	N3TFSB2	N3TFSB2FR
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	02	06	06
				Zone **: N2TF	N2TF	N3TF	AP	AP	AP
				Date: 10/19/94	10/19/94	10/18/94	10/19/94	10/19/94	10/19/94
1,2,4-Trichlorobenzene	68000	1200000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
1,2-Dichlorobenzene	5100000	10000000	50000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
1,3-Dichlorobenzene	5100000	10000000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
1,4-Dichlorobenzene	570000	10000000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	7400U	11000UJ	7400UJ	3700U	9000U	66000UJ
2,4,5-Trichlorophenol	5600000	10000000	50000	18000U	28000UJ	18000U	9100U	22000U	160000UJ
2,4,6-Trichlorophenol	62000	270000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2,4-Dichlorophenol	170000	3100000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2,4-Dimethylphenol	1100000	10000000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2,4-Dinitrophenol	110000	2100000	10000	18000U	28000UJ	18000UJ	9100U	22000U	160000UJ
2,4-Dinitrotoluene	1000	4000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2,6-Dinitrotoluene	1000	4000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2-Chloronaphthalene	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2-Chlorophenol	280000	5200000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2-Methylnaphthalene	--	--	--	7400U	9300J	1200J	3700U	5500J	15000J
2-Methylphenol	2800000	10000000	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
2-Nitroaniline	--	--	--	18000U	28000UJ	18000U	9100U	22000U	160000UJ
2-Nitrophenol	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
3,3'-Dichlorobenzidine	2000	6000	100000	7400UJ	11000UJ	7400U	3700UJ	9000UJ	66000UJ
3-Nitroaniline	--	--	--	18000U	28000UJ	18000U	9100U	22000U	160000UJ
4,6-Dinitro-2-methylphenol	--	--	--	18000UJ	28000UJ	18000U	9100U	22000U	160000UJ
4-Bromophenyl phenyl ether	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
4-Chloro-3-methylphenol	10000000	10000000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
4-Chloroaniline	230000	4200000	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
4-Chlorophenyl phenyl ether	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
4-Methylphenol	2800000	10000000	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
4-Nitroaniline	--	--	--	18000UJ	28000UJ	18000U	9100UJ	22000UJ	160000UJ
4-Nitrophenol	--	--	--	18000UJ	28000UJ	18000UJ	9100UJ	22000UJ	160000UJ
Acenaphthene	3400000	10000000	100000	7400U	11000UJ	7400U	3700U	3100J	66000UJ
Acenaphthylene	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Anthracene	10000000	10000000	100000	7400U	11000UJ	7400U	3700U	990J	66000UJ
Benzo(a)anthracene	900	4000	500000	7400U	1800J	1500J	460J	3100J	66000UJ
Benzo(a)pyrene	660	660	100000	7400U	11000UJ	840J	970J	4300J	66000UJ

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N2TFSB5	N2TFSB5	N3TFSB1	N3TFSB2	N3TFSB2	N3TFSB2FR
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	08	02	02	08	08
				Zone **: N2TF	N2TF	N3TF	AP	AP	AP
				Date: 10/19/94	10/19/94	10/18/94	10/19/94	10/19/94	10/19/94
Benzo(b)fluoranthene	900	4000	50000	7400U	11000UJ	980J	800J	2800J	66000UJ
Benzo(g,h,i)perylene	--	--	--	7400U	11000UJ	7400UJ	970J	1900J	66000UJ
Benzo(k)fluoranthene	900	4000	500000	7400UJ	11000UJ	1100J	800J	2800J	66000UJ
Butyl benzyl phthalate	1100000	10000000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Carbazole	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Chrysene	9000	40000	500000	7400U	2100J	3000J	710J	8200J	8900J
Di-n-butyl phthalate	5700000	10000000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Di-n-octyl phthalate	1100000	10000000	100000	7400U	11000UJ	7400UJ	3700U	9000U	66000UJ
Dibenzo(a,h)anthracene	660	660	100000	7400U	11000UJ	7400UJ	360J	1100J	66000UJ
Dibenzofuran	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Diethyl phthalate	10000000	10000000	50000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Dimethyl phthalate	10000000	10000000	50000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Fluoranthene	2300000	10000000	100000	7400U	11000UJ	7400U	3700U	2300J	66000UJ
Fluorene	2300000	10000000	100000	7400U	1900J	7400U	3700U	9000U	66000UJ
Hexachlorobenzene	660	2000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Hexachlorobutadiene	1000	21000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Hexachlorocyclopentadiene	400000	7300000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Hexachloroethane	6000	100000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Indeno(1,2,3-cd)pyrene	900	4000	500000	7400U	11000UJ	7400UJ	470J	930J	66000UJ
Isophorone	1100000	10000000	50000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
N-Nitroso-di-n-propylamine	660	660	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
N-Nitrosodiphenylamine	140000	600000	100000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Naphthalene	230000	4200000	100000	7400U	2200J	7400U	3700U	9000U	66000UJ
Nitrobenzene	28000	520000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Pentachlorophenol	6000	24000	100000	18000U	28000UJ	18000UJ	9100U	22000U	160000UJ
Phenanthrene	--	--	--	2000J	4500J	1800J	3700U	3200J	7100J
Phenol	10000000	10000000	50000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
Pyrene	1700000	10000000	100000	1500J	1500J	2900J	500J	5400J	11000J
bis(2-Chloroethoxy)methane	--	--	--	7400U	11000UJ	7400U	3700U	9000U	66000UJ
bis(2-Chloroethyl)ether	660	3000	10000	7400U	11000UJ	7400U	3700U	9000U	66000UJ
bis(2-Ethylhexyl)phthalate	49000	210000	100000	2400J	11000UJ	7400U	590J	1900J	66000UJ
Total Semivolatile Compounds				5900	23300	13320	6230	47520	42000

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB3	N3TFSB4	N3TFSB5	N3TFSB6	N3TFSB7	N3TFSB7
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	08	02	02	06
				Zone **: N3TF	N3TF	N3TF	N3TF	N3TF	N3TF
				Date: 10/13/94	10/17/94	10/19/94	10/18/94	10/18/94	10/18/94
1,2,4-Trichlorobenzene	88000	1200000	100000	390U	390U	R	80000U	250000U	80000U
1,2-Dichlorobenzene	5100000	10000000	50000	390U	82J	7800U	80000U	250000U	80000U
1,3-Dichlorobenzene	5100000	10000000	100000	390U	390U	7800U	80000U	250000U	80000U
1,4-Dichlorobenzene	570000	10000000	100000	390U	60J	R	80000U	250000U	80000U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	390UJ	390U	7800U	80000UJ	250000UJ	80000UJ
2,4,5-Trichlorophenol	5600000	10000000	50000	950U	940U	19000U	150000U	820000U	150000U
2,4,6-Trichlorophenol	82000	270000	10000	390U	390U	7800U	80000U	250000U	80000U
2,4-Dichlorophenol	170000	3100000	10000	390U	390U	7800U	80000U	250000U	80000U
2,4-Dimethylphenol	1100000	10000000	10000	390U	390U	7800U	80000U	250000U	80000U
2,4-Dinitrophenol	110000	2100000	10000	950UJ	940U	19000U	150000U	820000U	150000U
2,4-Dinitrotoluene	1000	4000	10000	390U	390U	R	80000U	250000U	80000U
2,6-Dinitrotoluene	1000	4000	10000	390U	390U	7800U	80000U	250000U	80000U
2-Chloronaphthalene	--	--	--	390U	390U	7800U	80000U	250000U	80000U
2-Chlorophenol	280000	5200000	10000	390U	390U	R	80000U	250000U	80000U
2-Methylnaphthalene	--	--	--	390U	380J	5500J	25000J	310000	88000
2-Methylphenol	2800000	10000000	--	390U	390U	7800U	80000U	250000U	80000U
2-Nitroaniline	--	--	--	950U	940U	19000U	150000U	820000U	150000U
2-Nitrophenol	--	--	--	390U	390U	7800U	80000U	250000U	80000U
3,3'-Dichlorobenzidine	2000	6000	100000	390U	390U	7800UJ	80000U	250000U	80000U
3-Nitroaniline	--	--	--	950U	940U	19000U	150000U	820000U	150000U
4,6-Dinitro-2-methylphenol	--	--	--	950U	940U	19000U	150000U	820000U	150000U
4-Bromophenyl phenyl ether	--	--	--	390U	390U	7800U	80000U	250000U	80000U
4-Chloro-3-methylphenol	10000000	10000000	100000	390U	390U	R	80000U	250000U	80000U
4-Chloroaniline	230000	4200000	--	390U	390U	7800U	80000UJ	250000UJ	80000UJ
4-Chlorophenyl phenyl ether	--	--	--	390U	390U	7800U	80000U	250000U	80000U
4-Methylphenol	2800000	10000000	--	390U	390U	7800U	80000U	250000U	80000U
4-Nitroaniline	--	--	--	950U	940U	19000UJ	150000U	820000U	150000U
4-Nitrophenol	--	--	--	950UJ	940U	R	150000U	820000U	150000U
Acenaphthene	3400000	10000000	100000	390U	40J	7800U	80000U	250000U	80000U
Acenaphthylene	--	--	--	390U	390U	7800U	80000U	250000U	80000U
Anthracene	10000000	10000000	100000	48J	130J	7800U	80000U	250000U	80000U
Benzo(a)anthracene	900	4000	500000	350J	200J	1000J	80000U	250000U	80000U
Benzo(a)pyrene	660	660	100000	330J	130J	7800U	80000U	250000U	80000U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB3	N3TFSB4	N3TFSB5	N3TFSB6	N3TFSB7	N3TFSB7
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	08	02	02	08
				Zone **: N3TF	N3TF	N3TF	N3TF	N3TF	N3TF
				Date: 10/13/94	10/17/94	10/19/94	10/18/94	10/18/94	10/18/94
Benzo(b)fluoranthene	900	4000	50000	890J	370J	7800U	80000U	250000U	60000U
Benzo(g,h,i)perylene	--	--	--	390UJ	390UJ	7800U	60000UJ	250000UJ	60000UJ
Benzo(k)fluoranthene	900	4000	500000	850J	420J	7800UJ	60000U	250000U	60000U
Butyl benzyl phthalate	1100000	10000000	100000	390U	390U	7800U	60000U	250000U	60000U
Carbazole	--	--	--	51J	390U	7800U	60000U	250000U	60000U
Chrysene	9000	40000	500000	410	350J	1500J	60000U	250000U	60000U
Di-n-butyl phthalate	5700000	10000000	100000	390U	150J	7800U	60000U	250000U	60000U
Di-n-octyl phthalate	1100000	10000000	100000	390UJ	390UJ	7800U	60000U	250000U	60000U
Dibenzo(a,h)anthracene	660	660	100000	390UJ	110J	7800U	60000UJ	250000UJ	60000UJ
Dibenzofuran	--	--	--	390U	390U	7800U	60000U	250000U	60000U
Diethyl phthalate	10000000	10000000	50000	390U	390U	7800U	60000U	250000U	60000U
Dimethyl phthalate	10000000	10000000	50000	390U	390U	7800U	60000U	250000U	60000U
Fluoranthene	2300000	10000000	100000	710	240J	7800U	60000U	250000U	60000U
Fluorene	2300000	10000000	100000	390U	390U	7800U	60000U	250000U	60000U
Hexachlorobenzene	660	2000	100000	390U	390U	7800U	60000U	250000U	60000U
Hexachlorobutadiene	1000	21000	100000	390U	390U	7800U	60000U	250000U	60000U
Hexachlorocyclopentadiene	400000	7300000	100000	390U	390U	7800U	60000U	250000U	60000U
Hexachloroethane	6000	100000	100000	390U	390U	7800U	60000U	250000U	60000U
Indeno(1,2,3-cd)pyrene	900	4000	500000	150J	89J	7800U	60000UJ	250000UJ	60000UJ
Isophorone	1100000	10000000	50000	390U	390U	7800U	60000U	250000U	60000U
N-Nitroso-di-n-propylamine	660	660	10000	390U	390U	R	60000U	250000U	60000U
N-Nitrosodiphenylamine	140000	600000	100000	390U	390U	7800U	60000UJ	150000J	60000UJ
Naphthalene	230000	4200000	100000	390U	91J	7800U	60000U	91000J	11000J
Nitrobenzene	28000	520000	10000	390U	390U	7800U	60000U	250000U	60000U
Pentachlorophenol	6000	24000	100000	950UJ	940U	19000U	150000U	620000U	150000U
Phenanthrene	--	--	--	310J	340J	1100J	12000J	94000J	7500J
Phenol	10000000	10000000	50000	390U	390U	7800U	60000U	250000U	60000U
Pyrene	1700000	10000000	100000	700	340J	1200J	60000U	250000U	60000U
bis(2-Chloroethoxy)methane	--	--	--	390U	390U	7800U	60000U	250000U	60000U
bis(2-Chloroethyl)ether	660	3000	10000	390U	390U	7800U	60000U	250000U	60000U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	110J	320J	7800U	60000U	250000U	60000U
Total Semivolatile Compounds				4909	3822	10300	37000	645000	84500

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB8	N3TFSB8	N3TFSB9	PN1SB2	PN1SB2	PSSB1
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	08	02	04	08	02
				Zone*: N3TF	N3TF	N3TF	P1	P1	MB
				Date: 10/18/94	10/18/94	11/02/94	11/02/94	11/02/94	10/31/94
1,2,4-Trichlorobenzene	68000	1200000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
1,2-Dichlorobenzene	5100000	10000000	50000	12000U	8000UJ	13000U	3700U	7700U	23000U
1,3-Dichlorobenzene	5100000	10000000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
1,4-Dichlorobenzene	570000	10000000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
2,4,5-Trichlorophenol	5800000	10000000	50000	29000U	20000UJ	32000U	8900U	19000U	58000U
2,4,6-Trichlorophenol	62000	270000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
2,4-Dichlorophenol	170000	3100000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
2,4-Dimethylphenol	1100000	10000000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
2,4-Dinitrophenol	110000	2100000	10000	29000UJ	20000UJ	32000UJ	8900U	19000U	58000UJ
2,4-Dinitrotoluene	1000	4000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
2,6-Dinitrotoluene	1000	4000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
2-Chloronaphthalene	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
2-Chlorophenol	280000	5200000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
2-Methylnaphthalene	--	--	--	13000	82000J	3300J	3700U	7700U	46000
2-Methylphenol	2800000	10000000	--	12000U	8000UJ	13000U	3700U	7700U	23000U
2-Nitroaniline	--	--	--	29000UJ	20000UJ	32000U	8900UJ	19000UJ	58000U
2-Nitrophenol	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
3,3'-Dichlorobenzidine	2000	6000	100000	12000U	8000UJ	13000UJ	3700U	7700U	23000UJ
3-Nitroaniline	--	--	--	29000U	20000UJ	32000U	8900U	19000U	58000U
4,6-Dinitro-2-methylphenol	--	--	--	29000UJ	20000UJ	32000UJ	8900U	19000U	58000UJ
4-Bromophenyl phenyl ether	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
4-Chloro-3-methylphenol	10000000	10000000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
4-Chloroaniline	230000	4200000	--	12000U	8000UJ	13000U	3700U	7700U	23000UJ
4-Chlorophenyl phenyl ether	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
4-Methylphenol	2800000	10000000	--	12000U	8000UJ	13000U	3700U	7700U	23000U
4-Nitroaniline	--	--	--	29000U	20000UJ	32000U	8900U	19000U	58000U
4-Nitrophenol	--	--	--	29000UJ	20000UJ	32000U	8900U	19000U	58000UJ
Acenaphthene	3400000	10000000	100000	1900J	2100J	13000U	3700U	7700U	23000U
Acenaphthylene	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
Anthracene	10000000	10000000	100000	12000U	8000UJ	13000U	3700U	1200J	23000U
Benzo(a)anthracene	900	4000	500000	12000U	8000UJ	13000U	3700U	5800J	23000U
Benzo(a)pyrene	660	660	100000	12000U	8000UJ	13000U	1200J	4400J	23000U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB8	N3TFSB8	N3TFSB9	PN1SB2	PN1SB2	PSSB1
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	04	08	02
				Zone **: N3TF	N3TF	N3TF	P1	P1	MB
				Date: 10/18/94	10/18/94	11/02/94	11/02/94	11/02/94	10/31/94
Benzo(b)fluoranthene	900	4000	50000	12000U	8000UJ	13000U	1400J	4700J	23000U
Benzo(g,h,i)perylene	--	--	--	12000UJ	8000UJ	13000UJ	1500J	2800J	23000UJ
Benzo(k)fluoranthene	900	4000	500000	12000U	8000UJ	13000U	1400J	4600J	23000U
Butyl benzyl phthalate	1100000	10000000	100000	12000U	8000UJ	13000U	3700UJ	7700UJ	23000U
Carbazole	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
Chrysene	9000	40000	500000	12000U	8000UJ	13000U	980J	8400	23000U
Di-n-butyl phthalate	5700000	10000000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
Di-n-octyl phthalate	1100000	10000000	100000	12000U	8000UJ	13000UJ	3700UJ	7700UJ	23000UJ
Dibenzo(a,h)anthracene	660	660	100000	12000UJ	8000UJ	13000UJ	740J	2000J	23000UJ
Dibenzofuran	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
Diethyl phthalate	10000000	10000000	50000	12000U	8000UJ	13000U	3700U	7700U	23000U
Dimethyl phthalate	10000000	10000000	50000	12000U	8000UJ	13000U	3700U	7700U	23000U
Fluoranthene	2300000	10000000	100000	12000U	8000UJ	13000U	930J	4000J	23000U
Fluorene	2300000	10000000	100000	2800J	3200J	13000U	3700U	1500J	23000U
Hexachlorobenzene	660	2000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
Hexachlorobutadiene	1000	21000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
Hexachlorocyclopentadiene	400000	7300000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
Hexachloroethane	6000	100000	100000	12000U	8000UJ	13000U	3700U	7700U	23000U
Indeno(1,2,3-cd)pyrene	900	4000	500000	12000UJ	8000UJ	13000UJ	790J	2000J	23000UJ
Isophorone	1100000	10000000	50000	12000U	8000UJ	13000U	3700U	7700U	23000U
N-Nitroso-di-n-propylamine	660	660	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
N-Nitrosodiphenylamine	140000	600000	100000	12000U	8000UJ	13000U	3700U	7700U	23000UJ
Naphthalene	230000	4200000	100000	4000J	8300J	13000U	3700U	7700U	23000U
Nitrobenzene	28000	520000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
Pentachlorophenol	6000	24000	100000	29000U	20000UJ	32000U	8900U	19000U	56000U
Phenanthrene	--	--	--	6300J	4200J	13000U	590J	6900J	2900J
Phenol	10000000	10000000	50000	12000U	8000UJ	13000U	3700U	7700U	23000U
Pyrene	1700000	10000000	100000	12000U	8000UJ	13000U	710J	4700J	23000U
bis(2-Chloroethoxy)methane	--	--	--	12000U	8000UJ	13000U	3700U	7700U	23000U
bis(2-Chloroethyl)ether	660	3000	10000	12000U	8000UJ	13000U	3700U	7700U	23000U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	12000U	8000UJ	13000U	3700UJ	7700UJ	2800J
Total Semivolatile Compounds				27800	99800	3300	10240	53000	51700

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: PSSB1	SSB1	SSB3	SSB3	STFSB1	STFSB1	STFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	16	06	10	02	06	08
				Zone **: MB	SS	SS	SS	STF	STF	STF
				Date: 10/31/94	10/24/94	10/24/94	10/24/94	10/26/94	10/26/94	10/26/94
1,2,4-Trichlorobenzene	68000	1200000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
1,2-Dichlorobenzene	5100000	10000000	50000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
1,3-Dichlorobenzene	5100000	10000000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
1,4-Dichlorobenzene	570000	10000000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2,4,5-Trichlorophenol	5800000	10000000	50000	29000U	29000UJ	13000UJ	11000UJ	29000U	170000U	64000U
2,4,6-Trichlorophenol	62000	270000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2,4-Dichlorophenol	170000	3100000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2,4-Dimethylphenol	1100000	10000000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2,4-Dinitrophenol	110000	2100000	10000	29000UJ	29000UJ	13000UJ	11000UJ	29000U	170000UJ	64000UJ
2,4-Dinitrotoluene	1000	4000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2,6-Dinitrotoluene	1000	4000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2-Chloronaphthalene	--	--	--	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2-Chlorophenol	280000	5200000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2-Methylnaphthalene	--	--	--	14000	1500J	5400UJ	490J	12000	180000	92000
2-Methylphenol	2800000	10000000	--	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
2-Nitroaniline	--	--	--	29000U	29000UJ	13000UJ	11000UJ	29000U	170000U	64000U
2-Nitrophenol	--	--	--	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
3,3'-Dichlorobenzidine	2000	6000	100000	12000UJ	12000UJ	5400UJ	4300UJ	12000UJ	67000UJ	26000UJ
3-Nitroaniline	--	--	--	29000U	29000UJ	13000UJ	11000UJ	29000U	170000U	64000U
4,6-Dinitro-2-methylphenol	--	--	--	29000UJ	29000UJ	13000UJ	11000UJ	29000U	170000UJ	64000UJ
4-Bromophenyl phenyl ether	--	--	--	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
4-Chloro-3-methylphenol	10000000	10000000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
4-Chloroaniline	230000	4200000	--	12000U	12000UJ	5400UJ	4300UJ	12000UJ	67000U	26000U
4-Chlorophenyl phenyl ether	--	--	--	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
4-Methylphenol	2800000	10000000	--	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
4-Nitroaniline	--	--	--	29000U	29000UJ	13000UJ	11000UJ	29000U	170000U	64000U
4-Nitrophenol	--	--	--	29000U	29000UJ	13000UJ	11000UJ	29000U	170000U	64000U
Acenaphthene	3400000	10000000	100000	12000U	12000UJ	2300J	4300UJ	1400J	67000U	6000J
Acenaphthylene	--	--	--	12000U	12000UJ	1100J	480J	12000U	67000U	26000U
Anthracene	10000000	10000000	100000	12000U	1700J	16000J	440J	11000J	11000J	2700J
Benzo(a)anthracene	900	4000	500000	7200J	7200J	64000J	6500J	1400J	67000U	3400J
Benzo(a)pyrene	660	660	100000	6100J	2200J	36000J	5900J	12000U	67000U	2600J

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: PSSB1	SSB1	SSB3	SSB3	STFSB1	STFSB1	STFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	16	06	10	02	06	08
				Zone **: MB	SS	SS	SS	STF	STF	STF
				Date: 10/31/94	10/24/94	10/24/94	10/24/94	10/26/94	10/26/94	10/26/94
Benzo(b)fluoranthene	900	4000	50000	3700J	2600J	<u>95000J</u>	<u>8400J</u>	1400J	67000U	26000U
Benzo(g,h,i)perylene	--	--	--	6300J	1400J	14000J	2500J	12000U	67000UJ	26000UJ
Benzo(k)fluoranthene	900	4000	500000	3800J	2700J	<u>95000J</u>	<u>8400J</u>	1400J	67000U	26000U
Butyl benzyl phthalate	1100000	10000000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Carbazole	--	--	--	12000U	12000UJ	3800J	4300UJ	4200J	67000U	26000U
Chrysene	9000	40000	500000	12000	14000J	<u>61000J</u>	4900J	2800J	67000U	5700J
Di-n-butyl phthalate	5700000	10000000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Di-n-octyl phthalate	1100000	10000000	100000	12000UJ	12000UJ	5400UJ	4300UJ	12000U	67000UJ	26000UJ
Dibenzo(a,h)anthracene	660	660	100000	<u>3300J</u>	12000UJ	<u>4600J</u>	<u>900J</u>	12000U	67000UJ	26000UJ
Dibenzofuran	--	--	--	12000U	12000UJ	3300J	4300UJ	12000U	67000U	26000U
Diethyl phthalate	10000000	10000000	50000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Dimethyl phthalate	10000000	10000000	50000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Fluoranthene	2300000	10000000	100000	12000U	4000J	1200J	5500J	2400J	67000U	26000U
Fluorene	2300000	10000000	100000	12000U	3400J	5800J	4300UJ	1800J	67000U	26000U
Hexachlorobenzene	660	2000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Hexachlorobutadiene	1000	21000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Hexachlorocyclopentadiene	400000	7300000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Hexachloroethane	6000	100000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Indeno(1,2,3-cd)pyrene	900	4000	500000	2300J	12000UJ	<u>14000J</u>	2400J	12000U	67000UJ	26000UJ
Isophorone	1100000	10000000	50000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
N-Nitroso-di-n-propylamine	660	660	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
N-Nitrosodiphenylamine	140000	600000	100000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Naphthalene	230000	4200000	100000	12000U	12000UJ	5400UJ	2000J	12000U	130000	26000U
Nitrobenzene	28000	520000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Pentachlorophenol	6000	24000	100000	29000U	29000UJ	13000UJ	11000UJ	9800J	170000U	64000U
Phenanthrene	--	--	--	3000J	7500J	84000J	1000J	6400J	11000J	22000J
Phenol	10000000	10000000	50000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Pyrene	1700000	10000000	100000	9800J	5400J	<u>120000J</u>	10000J	3100J	67000U	14000J
bis(2-Chloroethoxy)methane	--	--	--	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
bis(2-Chloroethyl)ether	660	3000	10000	12000U	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	2500J	12000UJ	5400UJ	4300UJ	12000U	67000U	26000U
Total Semivolatile Compounds				74000	53600	620900	59810	58700	332000	148400

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA1-100594	FBNA5-101994	FBNA6-102094	FBNA7-102594
	Residential	Non-Residential	Impact to Groundwater	Depth: Zone **:	10/19/94	10/20/94	10/25/94
				Date: 10/05/94			
1,2,4-Trichlorobenzene	68000	1200000	100000	10U	10U	10U	10U
1,2-Dichlorobenzene	5100000	10000000	50000	10U	10U	10U	10U
1,3-Dichlorobenzene	5100000	10000000	100000	10U	10U	10U	10U
1,4-Dichlorobenzene	570000	10000000	100000	10U	10U	10U	10U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	10U	10U	10U	10U
2,4,5-Trichlorophenol	5600000	10000000	50000	25U	25U	25U	25U
2,4,6-Trichlorophenol	62000	270000	10000	10U	10U	10U	10U
2,4-Dichlorophenol	170000	3100000	10000	10U	10U	10U	10U
2,4-Dimethylphenol	1100000	10000000	10000	10U	10U	10U	10U
2,4-Dinitrophenol	110000	2100000	10000	25U	25U	25U	25U
2,4-Dinitrotoluene	1000	4000	10000	10U	10U	10U	10U
2,6-Dinitrotoluene	1000	4000	10000	10U	10U	10U	10U
2-Chloronaphthalene	--	--	--	10U	10U	10U	10U
2-Chlorophenol	280000	5200000	10000	10U	10U	10U	10U
2-Methylnaphthalene	--	--	--	10U	10U	10U	10U
2-Methylphenol	2800000	10000000	--	10U	10U	10U	10U
2-Nitroaniline	--	--	--	25U	25U	25U	25U
2-Nitrophenol	--	--	--	10U	10U	10U	10U
3,3'-Dichlorobenzidine	2000	6000	100000	10U	10U	10U	10U
3-Nitroaniline	--	--	--	25U	25U	25U	25U
4,6-Dinitro-2-methylphenol	--	--	--	25U	25U	25U	25U
4-Bromophenyl phenyl ether	--	--	--	10U	10U	10U	10U
4-Chloro-3-methylphenol	10000000	10000000	100000	10U	10U	10U	10U
4-Chloroaniline	230000	4200000	--	10U	10U	10U	10U
4-Chlorophenyl phenyl ether	--	--	--	10U	10U	10U	10U
4-Methylphenol	2800000	10000000	--	10U	10U	10U	10U
4-Nitroaniline	--	--	--	25U	25U	25U	25U
4-Nitrophenol	--	--	--	25U	25U	25U	25U
Acenaphthene	3400000	10000000	100000	10U	10U	10U	10U
Acenaphthylene	--	--	--	10U	10U	10U	10U
Anthracene	10000000	10000000	100000	10U	10U	10U	10U
Benzo(a)anthracene	900	4000	500000	10U	10U	10U	10U
Benzo(a)pyrene	660	660	100000	10U	10U	10U	10U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA1-100594	FBNA5-101994	FBNA6-102094	FBNA7-102594
	Residential	Non-Residential	Impact to Groundwater	Depth: Zone**:	10/19/94	10/20/94	10/25/94
				Date: 10/05/94			
Benzo(b)fluoranthene	900	4000	50000	10U	10U	10U	10U
Benzo(g,h,i)perylene	--	--	--	10U	10U	10U	10U
Benzo(k)fluoranthene	900	4000	500000	10U	10U	10U	10U
Butyl benzyl phthalate	1100000	10000000	100000	10U	10U	10U	10U
Carbazole	--	--	--	10U	10U	10U	10U
Chrysene	9000	40000	500000	10U	10U	10U	10U
Di-n-butyl phthalate	5700000	10000000	100000	1J	3J	2J	2J
Di-n-octyl phthalate	1100000	10000000	100000	10U	10U	10U	10U
Dibenzo(a,h)anthracene	660	660	100000	10U	10U	10U	10U
Dibenzofuran	--	--	--	10U	10U	10U	10U
Diethyl phthalate	10000000	10000000	50000	10U	10U	10U	10U
Dimethyl phthalate	10000000	10000000	50000	10U	10U	10U	10U
Fluoranthene	2300000	10000000	100000	10U	10U	10U	10U
Fluorene	2300000	10000000	100000	10U	10U	10U	10U
Hexachlorobenzene	660	2000	100000	10U	10U	10U	10U
Hexachlorobutadiene	1000	21000	100000	10U	10U	10U	10U
Hexachlorocyclopentadiene	400000	7300000	100000	10U	10U	10U	10U
Hexachloroethane	6000	100000	100000	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	900	4000	500000	10U	10U	10U	10U
Isophorone	1100000	10000000	50000	10U	10U	10U	10U
N-Nitroso-di-n-propylamine	660	660	10000	10U	10U	10U	10U
N-Nitrosodiphenylamine	140000	600000	100000	10U	10U	10U	10U
Naphthalene	230000	4200000	100000	10U	10U	10U	10U
Nitrobenzene	28000	520000	10000	10U	10U	10U	10U
Pentachlorophenol	6000	24000	100000	25U	25U	25U	25U
Phenanthrene	--	--	--	10U	10U	10U	10U
Phenol	10000000	10000000	50000	10U	10U	10U	10U
Pyrene	1700000	10000000	100000	10U	10U	10U	10U
bis(2-Chloroethoxy)methane	--	--	--	10U	10U	10U	10U
bis(2-Chloroethyl)ether	660	3000	10000	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	10U	1J	10U	10U
Total Semivolatile Compounds				1	4	2	2

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA9-102694	FBNA11-102794	FBNA13-102894	FBNA14-102894
	Residential	Non-Residential	Impact to Groundwater	Depth:	10/27/94	10/28/94	10/28/94
				Zone **: Date: 10/26/94			
1,2,4-Trichlorobenzene	68000	1200000	100000	10U	10U	10U	10U
1,2-Dichlorobenzene	5100000	10000000	50000	10U	10U	10U	10U
1,3-Dichlorobenzene	5100000	10000000	100000	10U	10U	10U	10U
1,4-Dichlorobenzene	570000	10000000	100000	10U	10U	10U	10U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	10U	10U	10U	10U
2,4,5-Trichlorophenol	5600000	10000000	50000	25U	25U	25U	25U
2,4,6-Trichlorophenol	62000	270000	10000	10U	10U	10U	10U
2,4-Dichlorophenol	170000	3100000	10000	10U	10U	10U	10U
2,4-Dimethylphenol	1100000	10000000	10000	10U	10U	10U	10U
2,4-Dinitrophenol	110000	2100000	10000	25U	25U	25U	25U
2,4-Dinitrotoluene	1000	4000	10000	10U	10U	10U	10U
2,6-Dinitrotoluene	1000	4000	10000	10U	10U	10U	10U
2-Chloronaphthalene	--	--	--	10U	10U	10U	10U
2-Chlorophenol	280000	5200000	10000	10U	10U	10U	10U
2-Methylnaphthalene	--	--	--	10U	10U	10U	10U
2-Methylphenol	2800000	10000000	--	10U	10U	10U	10U
2-Nitroaniline	--	--	--	25U	25U	25U	25U
2-Nitrophenol	--	--	--	10U	10U	10U	10U
3,3'-Dichlorobenzidine	2000	6000	100000	10U	10U	10U	10U
3-Nitroaniline	--	--	--	25U	25U	25U	25U
4,6-Dinitro-2-methylphenol	--	--	--	25U	25U	25U	25U
4-Bromophenyl phenyl ether	--	--	--	10U	10U	10U	10U
4-Chloro-3-methylphenol	10000000	10000000	100000	10U	10U	10U	10U
4-Chloroaniline	230000	4200000	--	10U	10U	10U	10U
4-Chlorophenyl phenyl ether	--	--	--	10U	10U	10U	10U
4-Methylphenol	2800000	10000000	--	10U	10U	10U	10U
4-Nitroaniline	--	--	--	25U	25U	25U	25U
4-Nitrophenol	--	--	--	25U	25U	25U	25U
Acenaphthene	3400000	10000000	100000	10U	10U	10U	10U
Acenaphthylene	--	--	--	10U	10U	10U	10U
Anthracene	10000000	10000000	100000	10U	10U	10U	10U
Benzo(a)anthracene	900	4000	500000	10U	10U	10U	10U
Benzo(a)pyrene	660	660	100000	10U	10U	10U	10U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA9-102694	FBNA11-102794	FBNA13-102894	FBNA14-102894
	Residential	Non-Residential	Impact to Groundwater	Depth: Zone**:	10/27/94	10/28/94	10/28/94
				Date: 10/26/94			
Benzo(b)fluoranthene	900	4000	50000	10U	10U	10U	10U
Benzo(g,h,i)perylene	--	--	--	10U	10U	10U	10U
Benzo(k)fluoranthene	900	4000	500000	10U	10U	10U	10U
Butyl benzyl phthalate	1100000	10000000	100000	10U	10U	10U	10U
Carbazole	--	--	--	10U	10U	10U	10U
Chrysene	9000	40000	500000	10U	10U	10U	10U
Di-n-butyl phthalate	5700000	10000000	100000	10U	1J	2J	10U
Di-n-octyl phthalate	1100000	10000000	100000	10U	10U	10U	10U
Dibenzo(a,h)anthracene	660	660	100000	10U	10U	10U	10U
Dibenzofuran	--	--	--	10U	10U	10U	10U
Diethyl phthalate	10000000	10000000	50000	10U	10U	10U	10U
Dimethyl phthalate	10000000	10000000	50000	10U	10U	10U	10U
Fluoranthene	2300000	10000000	100000	10U	10U	10U	10U
Fluorene	2300000	10000000	100000	10U	10U	10U	10U
Hexachlorobenzene	660	2000	100000	10U	10U	10U	10U
Hexachlorobutadiene	1000	21000	100000	10U	10U	10U	10U
Hexachlorocyclopentadiene	400000	7300000	100000	10U	10U	10U	10U
Hexachloroethane	6000	100000	100000	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	900	4000	500000	10U	10U	10U	10U
Isophorone	1100000	10000000	50000	10U	10U	10U	10U
N-Nitroso-di-n-propylamine	660	660	10000	10U	10U	10U	10U
N-Nitrosodiphenylamine	140000	600000	100000	10U	10U	10U	10U
Naphthalene	230000	4200000	100000	10U	10U	10U	10U
Nitrobenzene	28000	520000	10000	10U	10U	10U	10U
Pentachlorophenol	6000	24000	100000	25U	25U	25U	25U
Phenanthrene	--	--	--	10U	10U	10U	10U
Phenol	10000000	10000000	50000	10U	10U	10U	10U
Pyrene	1700000	10000000	100000	10U	10U	10U	10U
bis(2-Chloroethoxy)methane	--	--	--	10U	10U	10U	10U
bis(2-Chloroethyl)ether	660	3000	10000	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	10U	10U	10U	3J
Total Semivolatile Compounds				0	1	2	3

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA17-103194
	Residential	Non-Residential	Impact to Groundwater	Depth: Zone **: Date: 10/31/94
1,2,4-Trichlorobenzene	68000	1200000	100000	10U
1,2-Dichlorobenzene	5100000	10000000	50000	10U
1,3-Dichlorobenzene	5100000	10000000	100000	10U
1,4-Dichlorobenzene	570000	10000000	100000	10U
2,2'-oxybis(1-Chloropropane)	2300000	10000000	10000	10U
2,4,5-Trichlorophenol	5600000	10000000	50000	25U
2,4,6-Trichlorophenol	62000	270000	10000	10U
2,4-Dichlorophenol	170000	3100000	10000	10U
2,4-Dimethylphenol	1100000	10000000	10000	10U
2,4-Dinitrophenol	110000	2100000	10000	25U
2,4-Dinitrotoluene	1000	4000	10000	10U
2,6-Dinitrotoluene	1000	4000	10000	10U
2-Chloronaphthalene	--	--	--	10U
2-Chlorophenol	280000	5200000	10000	10U
2-Methylnaphthalene	--	--	--	10U
2-Methylphenol	2800000	10000000	--	10U
2-Nitroaniline	--	--	--	25U
2-Nitrophenol	--	--	--	10U
3,3'-Dichlorobenzidine	2000	6000	100000	1J
3-Nitroaniline	--	--	--	1J
4,6-Dinitro-2-methylphenol	--	--	--	25U
4-Bromophenyl phenyl ether	--	--	--	10U
4-Chloro-3-methylphenol	10000000	10000000	100000	10U
4-Chloroaniline	230000	4200000	--	4J
4-Chlorophenyl phenyl ether	--	--	--	10U
4-Methylphenol	2800000	10000000	--	10U
4-Nitroaniline	--	--	--	25U
4-Nitrophenol	--	--	--	25U
Acenaphthene	3400000	10000000	100000	10U
Acenaphthylene	--	--	--	10U
Anthracene	10000000	10000000	100000	10U
Benzo(a)anthracene	900	4000	500000	10U
Benzo(a)pyrene	660	660	100000	10U

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA17-103194
	Residential	Non-Residential	Impact to Groundwater	Depth: Zone **: Date: 10/31/94
Benzo(b)fluoranthene	900	4000	50000	10U
Benzo(g,h,i)perylene	--	--	--	10U
Benzo(k)fluoranthene	900	4000	500000	10U
Butyl benzyl phthalate	1100000	10000000	100000	10U
Carbazole	--	--	--	10U
Chrysene	9000	40000	500000	10U
Di-n-butyl phthalate	5700000	10000000	100000	2J
Di-n-octyl phthalate	1100000	10000000	100000	10U
Dibenzo(a,h)anthracene	660	660	100000	10U
Dibenzofuran	--	--	--	10U
Diethyl phthalate	10000000	10000000	50000	10U
Dimethyl phthalate	10000000	10000000	50000	10U
Fluoranthene	2300000	10000000	100000	10U
Fluorene	2300000	10000000	100000	10U
Hexachlorobenzene	660	2000	100000	10U
Hexachlorobutadiene	1000	21000	100000	10U
Hexachlorocyclopentadiene	400000	7300000	100000	10U
Hexachloroethane	6000	100000	100000	10U
Indeno(1,2,3-cd)pyrene	900	4000	500000	10U
Isophorone	1100000	10000000	50000	10U
N-Nitroso-di-n-propylamine	660	660	10000	10U
N-Nitrosodiphenylamine	140000	600000	100000	10U
Naphthalene	230000	4200000	100000	10U
Nitrobenzene	28000	520000	10000	10U
Pentachlorophenol	6000	24000	100000	25U
Phenanthrene	--	--	--	10U
Phenol	10000000	10000000	50000	10U
Pyrene	1700000	10000000	100000	10U
bis(2-Chloroethoxy)methane	--	--	--	10U
bis(2-Chloroethyl)ether	660	3000	10000	10U
bis(2-Ethylhexyl)phthalate	49000	210000	100000	10U
Total Semivolatile Compounds				8

See last page for footnotes.



Table 5-3. Semivolatile Organic Compounds in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per kilogram (ug/kg) (equivalent to parts per billion [ppb]). Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols contained in the Statement of Work (SOW) OLM01.8.

Sample results exceeding the NJDEP Impact to groundwater criteria are shown in bold. Sample results exceeding the NJDEP non-residential criteria are underlined.

Sample results exceeding both criteria are shown in bold and underlined.

FBNA Indicates a field blank associated with non-aqueous samples.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specific detection limit.

J Estimated result.

R Rejected result.

-- No applicable criteria.

* NJDEP Soil Cleanup Criteria, February 3, 1992; last revised February 3, 1994.

** Zone as defined in Table 3-2.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: 3TFIRMB4	3TFIRMB4	AGTFSB1	AGTFSB1	AGTFSB2	AGTFSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	04	02
				Zone**: N3TF	N3TF	AGTF	AGTF	AGTF	AGTF
				Date: 10/17/94	10/17/94	10/20/94	10/20/94	10/28/94	10/27/94
4,4'-DDD	3000	12000	50000	3.9U	3.8UJ	4.3UJ	21UJ	19U	R
4,4'-DDE	2000	9000	50000	84	R	14J	21UJ	19U	20U
4,4'-DDT	2000	9000	500000	R	3.8UJ	R	21UJ	19U	R
Aldrin	40	170	50000	18J	2UJ	2.2UJ	17J	9.6U	10U
Aroclor-1016	490	2000	50000	39U	38UJ	43UJ	210UJ	190U	200U
Aroclor-1221	490	2000	50000	79U	78UJ	87UJ	440UJ	380U	400U
Aroclor-1232	490	2000	50000	39U	38UJ	43UJ	210UJ	190U	200U
Aroclor-1242	490	2000	50000	39U	38UJ	43UJ	210UJ	190U	200U
Aroclor-1248	490	2000	50000	39U	38UJ	43UJ	210UJ	190U	200U
Aroclor-1254	490	2000	50000	39U	38UJ	43UJ	210UJ	190U	200U
Aroclor-1260	490	2000	50000	39U	38UJ	43UJ	210UJ	190U	200U
Dieldrin	42	180	50000	3.9U	3.8UJ	4.3UJ	21UJ	19U	20U
Endosulfan I	--	--	--	2U	2UJ	R	11UJ	9.6U	10U
Endosulfan II	--	--	--	3.9U	3.8UJ	4.3UJ	21UJ	19U	20U
Endosulfan sulfate	--	--	--	R	3.8UJ	4.3UJ	21UJ	19U	20U
Endrin	17000	310000	50000	7.3J	3.8UJ	4.3UJ	21UJ	19U	20UJ
Endrin aldehyde	--	--	--	3.9U	3.8UJ	21J	21UJ	19U	20U
Endrin ketone	--	--	--	11	3.8UJ	4.3UJ	21UJ	19U	20U
Heptachlor	150	650	50000	2U	2UJ	2.2UJ	11UJ	9.6U	10U
Heptachlor epoxide	--	--	--	2U	2UJ	2.2UJ	11UJ	9.6U	10U
Methoxychlor	280000	5200000	50000	20U	210J	170J	110UJ	96U	100U
Toxaphene	100	200	50000	200U	200UJ	220UJ	1100UJ	980U	1000U
alpha-BHC	--	--	--	2U	5.6J	2.2UJ	11UJ	9.6U	10U
alpha-Chlordane	--	--	--	11	2.3J	5J	11UJ	9.6U	10U
beta-BHC	--	--	--	2U	2UJ	2.2UJ	11UJ	9.6U	10U
delta-BHC	--	--	--	2U	2UJ	2.2UJ	11UJ	9.6U	10U
gamma-BHC (Lindane)	520	2200	50000	2U	R	2.2UJ	11UJ	9.6U	10U
gamma-Chlordane	--	--	--	13J	2UJ	2J	11UJ	9.6U	10U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: AGTFSB4	AHTFSB1	AHTFSB2	AHTFSB4	AHTFSB4	APSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02 Zone **: AGTF Date: 10/20/94	02 AHTF 10/19/94	02 AHTF 10/14/94	02 AHTF 10/14/94	08 AHTF 10/14/94	02 AP 10/26/94
4,4'-DDD	3000	12000	50000	3.9UJ	6.9J	19U	21	19U	R
4,4'-DDE	2000	9000	50000	3.9UJ	3.6UJ	19U	18U	19U	34
4,4'-DDT	2000	9000	500000	6.9J	4.9J	19U	18U	19U	120
Aldrin	40	170	50000	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
Aroclor-1016	490	2000	50000	39UJ	36UJ	190U	180U	190U	38U
Aroclor-1221	490	2000	50000	79UJ	73UJ	390U	370U	390U	77U
Aroclor-1232	490	2000	50000	39UJ	36UJ	190U	180U	190U	38U
Aroclor-1242	490	2000	50000	39UJ	36UJ	190U	180U	190U	38U
Aroclor-1248	490	2000	50000	39UJ	36UJ	190U	180U	190U	38U
Aroclor-1254	490	2000	50000	39UJ	36UJ	190U	180U	190U	38U
Aroclor-1260	490	2000	50000	39UJ	36UJ	190U	180U	190U	38U
Dieldrin	42	180	50000	3.9UJ	3.6UJ	19U	18U	19U	17
Endosulfan I	--	--	--	3.4J	1.8UJ	9.8U	9.4U	9.8U	2U
Endosulfan II	--	--	--	3.9UJ	3.6UJ	19U	18U	19U	3.8U
Endosulfan sulfate	--	--	--	R	3.6UJ	19U	18U	19U	3.8U
Endrin	17000	310000	50000	3.9UJ	3.6UJ	19U	18U	19U	3.8U
Endrin aldehyde	--	--	--	3.9UJ	3.6UJ	19U	18U	19U	3.8U
Endrin ketone	--	--	--	3.9J	3.6UJ	19U	18U	19U	3.7J
Heptachlor	150	650	50000	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
Heptachlor epoxide	--	--	--	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
Methoxychlor	280000	5200000	50000	20UJ	18UJ	98U	94U	98U	20U
Toxaphene	100	200	50000	200UJ	180UJ	980U	940U	980U	200U
alpha-BHC	--	--	--	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
alpha-Chlordane	--	--	--	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
beta-BHC	--	--	--	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
delta-BHC	--	--	--	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
gamma-BHC (Lindane)	520	2200	50000	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U
gamma-Chlordane	--	--	--	2UJ	1.8UJ	9.8U	9.4U	9.8U	2U

See last page for footnotes.



Table 5-4: Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: APSB5	APSB5	APSB6	APSB6	DTSB3	DTSB3FR
	Residential	Non-Residential	Impact to Groundwater	Depth: 02 Zone**: AP Date: 10/12/94	06 AP 10/12/94	06 AP 10/21/94	10 AP 10/21/94	04 DT 10/27/94	04 DT 10/27/94
4,4'-DDD	3000	12000	50000	3.5U	21U	18UJ	21UJ	81J	19J
4,4'-DDE	2000	9000	50000	16J	21U	18UJ	21UJ	20UJ	20UJ
4,4'-DDT	2000	9000	500000	81J	21U	18UJ	58J	20UJ	20UJ
Aldrin	40	170	50000	1.8U	11U	9.4UJ	11UJ	10UJ	10UJ
Aroclor-1018	490	2000	50000	35U	210U	180UJ	210UJ	200UJ	200UJ
Aroclor-1221	490	2000	50000	71U	430U	370UJ	430UJ	410UJ	410UJ
Aroclor-1232	490	2000	50000	35U	210U	180UJ	210UJ	200UJ	200UJ
Aroclor-1242	490	2000	50000	35U	210U	180UJ	210UJ	200UJ	200UJ
Aroclor-1248	490	2000	50000	35U	210U	180UJ	210UJ	200UJ	200UJ
Aroclor-1254	490	2000	50000	35U	210U	180UJ	210UJ	200UJ	200UJ
Aroclor-1260	490	2000	50000	77	210U	180UJ	210UJ	200UJ	200UJ
Dieldrin	42	180	50000	8.3J	21U	18UJ	21UJ	20UJ	20UJ
Endosulfan I	--	--	--	1.8U	11U	9.4UJ	11UJ	10UJ	10UJ
Endosulfan II	--	--	--	3.5U	21U	18UJ	21UJ	20UJ	20UJ
Endosulfan sulfate	--	--	--	3.5U	21U	18UJ	21UJ	20UJ	20UJ
Endrin	17000	310000	50000	3.5U	21U	18UJ	21UJ	20UJ	20UJ
Endrin aldehyde	--	--	--	3.5U	88J	18UJ	21UJ	20UJ	20UJ
Endrin ketone	--	--	--	3.5U	36	18UJ	21UJ	10J	20UJ
Heptachlor	150	650	50000	R	11U	9.4UJ	11UJ	10UJ	10UJ
Heptachlor epoxide	--	--	--	1.8U	11U	9.4UJ	11UJ	10UJ	10UJ
Methoxychlor	280000	5200000	50000	18U	270J	94UJ	55J	100UJ	100UJ
Toxaphene	100	200	50000	180U	1100U	940UJ	1100UJ	1000UJ	1000UJ
alpha-BHC	--	--	--	1.8U	11U	9.4UJ	11UJ	10UJ	10UJ
alpha-Chlordane	--	--	--	7	39J	9.4UJ	21J	10UJ	10UJ
beta-BHC	--	--	--	1.8U	11U	9.4UJ	11UJ	10UJ	10UJ
delta-BHC	--	--	--	1.8U	11U	9.4UJ	11UJ	10UJ	10UJ
gamma-BHC (Lindane)	520	2200	50000	1.8U	11U	9.4UJ	11UJ	10UJ	10UJ
gamma-Chlordane	--	--	--	7.4J	11U	9.4UJ	11UJ	12J	10UJ

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: ECIRMB1	ECIRMB3	ECIRMB3	ECPSB1	ECPSB2	ECPSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02 Zone **: U Date: 10/24/94	02 N3TF 10/19/94	06 N3TF 10/19/94	02 ECP 10/20/94	06 ECP 10/20/94	12 ECP 10/20/94
4,4'-DDD	3000	12000	50000	62	4.6J	22UJ	3.8UJ	19UJ	R
4,4'-DDE	2000	9000	50000	8.9J	4.7	22UJ	8.7J	19UJ	23UJ
4,4'-DDT	2000	9000	500000	200	17J	22UJ	R	19UJ	23UJ
Aldrin	40	170	50000	2U	1.9U	11UJ	1.9UJ	9.8UJ	12UJ
Aroclor-1016	490	2000	50000	38U	37U	220UJ	38UJ	190UJ	230UJ
Aroclor-1221	490	2000	50000	78U	75U	440UJ	77UJ	390UJ	470UJ
Aroclor-1232	490	2000	50000	38U ^d	37U	220UJ	38UJ	190UJ	230UJ
Aroclor-1242	490	2000	50000	38U	37U	220UJ	38UJ	190UJ	230UJ
Aroclor-1248	490	2000	50000	38U	37U	220UJ	38UJ	190UJ	230UJ
Aroclor-1254	490	2000	50000	38U	37U	220UJ	38UJ	190UJ	230UJ
Aroclor-1260	490	2000	50000	38U	37U	220UJ	38UJ	190UJ	230UJ
Dieldrin	42	180	50000	27	2.2J	22UJ	3.8UJ	19UJ	R
Endosulfan I	--	--	--	2U	1.9U	11UJ	1.9UJ	9.8UJ	12UJ
Endosulfan II	--	--	--	3.8U	3.7U	22UJ	3.8UJ	19UJ	23UJ
Endosulfan sulfate	--	--	--	3.8U	3.7U	22UJ	3.8UJ	19UJ	23UJ
Endrin	17000	310000	50000	3.8U	3.7U	22UJ	3.8UJ	19UJ	23UJ
Endrin aldehyde	--	--	--	R	3.7U	22UJ	3.8UJ	19UJ	23UJ
Endrin ketone	--	--	--	3.8U	3.7U	22UJ	1.7J	19UJ	23UJ
Heptachlor	150	650	50000	2U	1.9U	11UJ	1.9UJ	9.8UJ	12UJ
Heptachlor epoxide	--	--	--	2U	1.9U	11UJ	1.9UJ	9.8UJ	12UJ
Methoxychlor	280000	5200000	50000	130	19U	110UJ	91J	98UJ	120UJ
Toxaphene	100	200	50000	200U	190U	1100UJ	190UJ	980UJ	1200UJ
alpha-BHC	--	--	--	2U	R	11UJ	R	9.8UJ	12UJ
alpha-Chlordane	--	--	--	3.8U	2.5J	11UJ	1.9UJ	9.8UJ	12UJ
beta-BHC	--	--	--	2U	1.9U	11UJ	1.9UJ	9.8UJ	12UJ
delta-BHC	--	--	--	2U	1.9U	11UJ	1.9UJ	9.8UJ	12UJ
gamma-BHC (Lindane)	520	2200	50000	2U	1.9U	11UJ	1.9UJ	9.8UJ	12UJ
gamma-Chlordane	--	--	--	R	1.9U	11UJ	1.9UJ	9.8UJ	12UJ

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: ECPSB4	ECPSB5	GFSB1	GTFRMB1	GTFRMB2	GTFRMB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 08	02	02	02	02	02
				Zone **: ECP	ECP	STF	GTF	GTF	GTF
				Date: 10/19/94	10/19/94	10/12/94	10/6/94	10/17/94	11/16/94
4,4'-DDD	3000	12000	50000	20UJ	R	72J	R	R	190
4,4'-DDE	2000	9000	50000	46J	5.3J	3.8UJ	8.5J	32J	38
4,4'-DDT	2000	9000	500000	20UJ	3.8UJ	75J	58J	84J	98J
Aldrin	40	170	50000	110J	2UJ	1.9UJ	1.9UJ	1.9UJ	9.3U
Aroclor-1016	490	2000	50000	200UJ	38UJ	38UJ	37UJ	37UJ	180U
Aroclor-1221	490	2000	50000	400UJ	78UJ	76UJ	74UJ	76UJ	370U
Aroclor-1232	490	2000	50000	200UJ	38UJ	38UJ	37UJ	37UJ	180U
Aroclor-1242	490	2000	50000	200UJ	38UJ	38UJ	37UJ	37UJ	180U
Aroclor-1248	490	2000	50000	200UJ	38UJ	38UJ	37UJ	37UJ	180U
Aroclor-1254	490	2000	50000	200UJ	38UJ	38UJ	37UJ	37UJ	180U
Aroclor-1260	490	2000	50000	200UJ	38UJ	38UJ	37UJ	37UJ	180U
Dieldrin	42	180	50000	20UJ	3.8UJ	3.8UJ	4J	10J	21
Endosulfan I	--	--	--	35J	2UJ	1.9UJ	1.9UJ	1.9UJ	9.3U
Endosulfan II	--	--	--	20UJ	3.8UJ	3.8UJ	3.7UJ	3.7UJ	18U
Endosulfan sulfate	--	--	--	20UJ	3.8UJ	3.8UJ	3.7UJ	3.7UJ	18U
Endrin	17000	310000	50000	20UJ	3.8UJ	3.8UJ	3.7UJ	3.7UJ	18U
Endrin aldehyde	--	--	--	20UJ	3.8UJ	3.8UJ	3.7UJ	3.7UJ	18U
Endrin ketone	--	--	--	20UJ	15J	6.4J	3.7UJ	3.7UJ	18U
Heptachlor	150	650	50000	10UJ	2UJ	1.9UJ	1.8UJ	1.9UJ	9.3U
Heptachlor epoxide	--	--	--	10UJ	2UJ	1.9UJ	1.9UJ	1.9UJ	9.3U
Methoxychlor	280000	5200000	50000	100UJ	20UJ	19UJ	19UJ	19UJ	100
Toxaphene	100	200	50000	1000UJ	200UJ	190UJ	190UJ	190UJ	930U
alpha-BHC	--	--	--	10UJ	2UJ	1.9UJ	1.9UJ	1.9UJ	9.3U
alpha-Chlordane	--	--	--	39J	R	R	1.9UJ	1.9UJ	9.3U
beta-BHC	--	--	--	10UJ	2UJ	1.9UJ	1.9UJ	1.9UJ	9.3U
delta-BHC	--	--	--	10UJ	2UJ	1.9UJ	1.9UJ	1.9UJ	9.3U
gamma-BHC (Lindane)	520	2200	50000	10UJ	2UJ	1.9UJ	1.9UJ	1.9UJ	9.3U
gamma-Chlordane	--	--	--	63J	2UJ	1.9UJ	7.3J	1.9UJ	75

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB4	GTFIRMB5	GTFIRMB5FR	GTFIRMB5	GTFIRMB6
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	02	06	04
				Zone **: GTF	GTF	GTF	GTF	GTF
				Date: 10/17/94	10/05/94	10/05/94	11/16/94	11/16/94
4,4'-DDD	3000	12000	50000	22J	4.1U	4.2U	12J	R
4,4'-DDE	2000	9000	50000	23J	4.8J	6.3J	4.3UJ	24U
4,4'-DDT	2000	9000	500000	6.9J	R	R	4.3UJ	24U
Aldrin	40	170	50000	2UJ	R	2.7J	2.2UJ	12U
Aroclor-1016	490	2000	50000	39UJ	41U	42U	43UJ	240U
Aroclor-1221	490	2000	50000	80UJ	83U	85U	88UJ	490U
Aroclor-1232	490	2000	50000	39UJ	41U	42U	43UJ	240U
Aroclor-1242	490	2000	50000	39UJ	41U	42U	43UJ	240U
Aroclor-1248	490	2000	50000	39UJ	41U	42U	43UJ	240U
Aroclor-1254	490	2000	50000	39UJ	41U	42U	43UJ	240U
Aroclor-1260	490	2000	50000	39UJ	41U	42U	43UJ	240U
Dieldrin	42	180	50000	3.9UJ	9.3	9.8	4.3UJ	32J
Endosulfan I	--	--	--	2UJ	5.4J	2.1U	2.2UJ	12U
Endosulfan II	--	--	--	3.9UJ	4.1U	4.2U	4.3UJ	24U
Endosulfan sulfate	--	--	--	3.9UJ	4.1U	4.2U	4.3UJ	24U
Endrin	17000	310000	50000	3.7J	4.1U	4.2U	4.3UJ	R
Endrin aldehyde	--	--	--	3.9UJ	9.6J	4.2UJ	4.4J	24U
Endrin ketone	--	--	--	3.9UJ	4.1U	4.2U	4.3UJ	24U
Heptachlor	150	650	50000	2UJ	2.1U	2.1U	2.2UJ	12U
Heptachlor epoxide	--	--	--	2UJ	R	5.1	2.2UJ	12J
Methoxychlor	280000	5200000	50000	20UJ	110J	83J	22UJ	210
Toxaphene	100	200	50000	200UJ	210U	210U	220UJ	1200U
alpha-BHC	--	--	--	2UJ	2.1U	2.1U	2.2UJ	12U
alpha-Chlordane	--	--	--	2UJ	2.1U	2.1U	2.2UJ	12U
beta-BHC	--	--	--	2UJ	2.1U	2.1U	2.2UJ	12U
delta-BHC	--	--	--	2UJ	2.1U	2.1U	2.2UJ	12U
gamma-BHC (Lindane)	520	2200	50000	2UJ	2.1U	2.1U	2.2UJ	12U
gamma-Chlordane	--	--	--	3.6J	23	23	R	R

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFIRMB7	GTFIRMB8	GTFIRMB8	GTFIRMB9	GTFBS1
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	08	02	02
				Zone **: GTF	GTF	GTF	GTF	GTF
				Date: 10/17/94	10/18/94	10/18/94	10/05/94	10/10/94
4,4'-DDD	3000	12000	50000	3.7U	8.2J	4.3UJ	7.8J	18J
4,4'-DDE	2000	9000	50000	3.7U	3.8UJ	4.3UJ	7.3	4UJ
4,4'-DDT	2000	9000	500000	13J	3.8UJ	11J	35	4.6J
Aldrin	40	170	50000	1.9U	2UJ	2.2UJ	2.1U	2UJ
Aroclor-1016	490	2000	50000	37U	38UJ	43UJ	41U	40UJ
Aroclor-1221	490	2000	50000	76U	77UJ	87UJ	83U	81UJ
Aroclor-1232	490	2000	50000	37U	38UJ	43UJ	41U	40UJ
Aroclor-1242	490	2000	50000	37U	38UJ	43UJ	41U	40UJ
Aroclor-1248	490	2000	50000	37U	38UJ	43UJ	41U	40UJ
Aroclor-1254	490	2000	50000	37U	38UJ	43UJ	41U	40UJ
Aroclor-1260	490	2000	50000	37U	38UJ	43UJ	41U	40UJ
Dieldrin	42	180	50000	4.4	3.8UJ	11J	4.1U	4UJ
Endosulfan I	--	--	--	1.9U	2UJ	2.2UJ	2.1U	2UJ
Endosulfan II	--	--	--	3.7U	3.8UJ	4.3UJ	4.1U	4UJ
Endosulfan sulfate	--	--	--	3.7U	3.8UJ	4.3UJ	4.1U	R
Endrin	17000	310000	50000	3.7U	3.8UJ	4.3UJ	4.1U	4UJ
Endrin aldehyde	--	--	--	3.7U	.79J	4.3UJ	4.1U	R
Endrin ketone	--	--	--	3.7U	3.8UJ	4.3UJ	4.1U	4UJ
Heptachlor	150	650	50000	1.9U	2UJ	2.2UJ	2.1U	2UJ
Heptachlor epoxide	--	--	--	5.3J	2UJ	2.2UJ	24	2UJ
Methoxychlor	280000	5200000	50000	19U	20UJ	22UJ	21U	R
Toxaphene	100	200	50000	190U	200UJ	220UJ	210U	200UJ
alpha-BHC	--	--	--	1.9U	2UJ	2.2UJ	2.1U	2UJ
alpha-Chlordane	--	--	--	1.9U	1.5J	R	2.1U	2UJ
beta-BHC	--	--	--	1.9U	2UJ	2.2UJ	2.1U	2UJ
delta-BHC	--	--	--	1.9U	2UJ	2.2UJ	2.1U	2UJ
gamma-BHC (Lindane)	520	2200	50000	1.9U	2UJ	2.2UJ	2.1U	2UJ
gamma-Chlordane	--	--	--	12J	3.3J	6.8J	35	2.5J

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB1	GTFSB2	GTFSB3	GTFSB4	GTFSB5	GTFSB6
	Residential	Non-Residential	Impact to Groundwater	Depth: 08	02	02	02	02	02
				Zone **: GTF	GTF	GTF	GTF	GTF	GTF
				Date: 10/10/94	10/13/94	10/10/94	10/13/94	10/13/94	10/11/94
4,4'-DDD	3000	12000	50000	R	20U	3.9U	81	3.5UJ	14
4,4'-DDE	2000	9000	50000	R	20U	6.1	17	3.5UJ	18
4,4'-DDT	2000	9000	500000	R	100J	20	360	3.5UJ	120
Aldrin	40	170	50000	R	10U	2U	3J	1.8UJ	1.9U
Aroclor-1016	490	2000	50000	R	200U	39U	37U	35UJ	37U
Aroclor-1221	490	2000	50000	R	410U	79U	75U	72UJ	76U
Aroclor-1232	490	2000	50000	R	200U	39U	37U	35UJ	37U
Aroclor-1242	490	2000	50000	R	200U	39U	37U	35UJ	37U
Aroclor-1248	490	2000	50000	R	200U	39U	37U	35UJ	37U
Aroclor-1254	490	2000	50000	R	200U	39U	37U	35UJ	37U
Aroclor-1260	490	2000	50000	R	200U	39U	37U	35UJ	37U
Dieldrin	42	180	50000	R	20U	3.9U	12	3.5UJ	6.4
Endosulfan I	--	--	--	R	10U	2U	1.9U	1.8UJ	1.9U
Endosulfan II	--	--	--	R	20U	3.9U	3.7U	3.5UJ	3.7U
Endosulfan sulfate	--	--	--	R	20U	3.9U	3.7U	3.5UJ	3.7U
Endrin	17000	310000	50000	R	20U	3.9U	3.7U	3.5UJ	3.7U
Endrin aldehyde	--	--	--	R	20U	3.9U	3.7U	3.5UJ	3.7U
Endrin ketone	--	--	--	R	20U	3.9U	4.4	3.5UJ	94
Heptachlor	150	650	50000	R	10U	2U	1.9U	1.8UJ	1.9U
Heptachlor epoxide	--	--	--	R	10U	2U	R	1.8UJ	1.9U
Methoxychlor	280000	5200000	50000	R	100U	20U	19U	18UJ	19U
Toxaphene	100	200	50000	R	1000U	200U	190U	180UJ	190U
alpha-BHC	--	--	--	R	10U	2U	1.9U	1.8UJ	1.9U
alpha-Chlordane	--	--	--	R	10U	2U	9.6	1.8UJ	9.6
beta-BHC	--	--	--	R	10U	2U	1.9U	1.8UJ	1.9U
delta-BHC	--	--	--	R	10U	2U	1.9U	1.8UJ	1.9U
gamma-BHC (Lindane)	520	2200	50000	R	10U	2U	1.9U	1.8UJ	1.9U
gamma-Chlordane	--	--	--	R	10U	2U	27J	1.8UJ	2.2J

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: GTFSB7	GTFSB7	GTFSB8	GTFSB8	GTFSB9	GTFSB9
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	08	04	08	02	08
				Zone*: GTF	GTF	GTF	GTF	GTF	GTF
				Date: 10/11/94	10/13/94	10/13/94	10/13/94	10/13/94	11/16/94
4,4'-DDD	3000	12000	50000	15	22U	19U	22U	17J	19U
4,4'-DDE	2000	9000	50000	3.8U	22U	19U	22U	12	19U
4,4'-DDT	2000	9000	500000	3.8U	22U	19U	22U	19	19U
Aldrin	40	170	50000	2U	12U	9.8U	11U	3.9	9.9U
Aroclor-1016	490	2000	50000	38U	220U	190U	220U	36U	190U
Aroclor-1221	490	2000	50000	77U	460U	390U	450U	73U	390U
Aroclor-1232	490	2000	50000	38U	220U	190U	220U	36U	190U
Aroclor-1242	490	2000	50000	38U	220U	190U	220U	36U	190U
Aroclor-1248	490	2000	50000	38U	220U	190U	220U	36U	190U
Aroclor-1254	490	2000	50000	38U	220U	190U	220U	36U	190U
Aroclor-1260	490	2000	50000	38U	220U	190U	220U	36U	190U
Dieldrin	42	180	50000	3.8U	22U	19U	22U	3.6U	19U
Endosulfan I	--	--	--	2U	12U	9.8U	11U	1.8U	9.9U
Endosulfan II	--	--	--	3.8U	22U	19U	22U	3.6U	19U
Endosulfan sulfate	--	--	--	3.8U	22U	19U	22U	3.6U	19U
Endrin	17000	310000	50000	3.8U	22U	19U	22U	3.6U	19U
Endrin aldehyde	--	--	--	3.8U	22U	19U	22U	3.6U	26J
Endrin ketone	--	--	--	3.8U	22U	19U	22U	3.6U	19U
Heptachlor	150	650	50000	2U	12U	9.8U	11U	1.8U	9.9U
Heptachlor epoxide	--	--	--	2U	12U	9.8U	11U	1.8U	9.9U
Methoxychlor	280000	5200000	50000	20U	120U	98U	110U	18U	99U
Toxaphene	100	200	50000	200U	1200U	980U	1100U	180U	990U
alpha-BHC	--	--	--	2U	12U	9.8U	11U	1.8U	9.9U
alpha-Chlordane	--	--	--	2.4	12U	9.8U	11U	1.8U	9.9U
beta-BHC	--	--	--	2U	12U	9.8U	11U	1.8U	9.9U
delta-BHC	--	--	--	2U	12U	9.8U	11U	1.8U	9.9U
gamma-BHC (Lindane)	520	2200	50000	2U	12U	9.8U	11U	1.8U	9.9U
gamma-Chlordane	--	--	--	2U	12U	9.8U	12J	1.8U	9.9U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LAIRMB1	LOSB1	LOSB1	LOSB2	LOSB2	LOSB3
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	04	08	04	08	02
				Zone**: LO	LO	LO	LO	LO	LO
				Date: 10/24/94	10/25/94	10/25/94	10/14/94	10/14/94	10/24/94
4,4'-DDD	3000	12000	50000	85000	19UJ	19U	43	31U	4U
4,4'-DDE	2000	9000	50000	R	19UJ	19U	23U	31U	4U
4,4'-DDT	2000	9000	500000	46000	19UJ	19U	23U	130	4U
Aldrin	40	170	50000	450U	32J	9.8U	12U	16U	2.1U
Aroclor-1018	490	2000	50000	8800U	190UJ	190U	230U	310U	40U
Aroclor-1221	490	2000	50000	18000U	390UJ	390U	470U	620U	82U
Aroclor-1232	490	2000	50000	8800U	190UJ	190U	230U	310U	40U
Aroclor-1242	490	2000	50000	8800U	190UJ	190U	230U	310U	40U
Aroclor-1248	490	2000	50000	8800U	190UJ	190U	230U	310U	40U
Aroclor-1254	490	2000	50000	8800U	190UJ	190U	230U	310U	40U
Aroclor-1260	490	2000	50000	8800U	190UJ	190U	230U	310U	40U
Dieldrin	42	180	50000	5600J	19UJ	19U	23U	31U	4U
Endosulfan I	--	--	--	450U	9.9UJ	9.8U	12U	16U	2.1U
Endosulfan II	--	--	--	880U	19UJ	19U	23U	31U	4U
Endosulfan sulfate	--	--	--	880U	19UJ	19U	23U	31U	4U
Endrin	17000	310000	50000	880U	19UJ	19U	23U	31U	4U
Endrin aldehyde	--	--	--	880U	R	19U	23U	R	4U
Endrin ketone	--	--	--	R	19UJ	19U	23U	74J	4U
Heptachlor	150	650	50000	450U	9.9UJ	9.8U	12U	16U	2.1U
Heptachlor epoxide	--	--	--	450U	9.9UJ	9.8U	12U	16U	2.1U
Methoxychlor	280000	5200000	50000	4500U	99UJ	98U	120U	160U	21U
Toxaphene	100	200	50000	45000U	990UJ	980U	1200U	1600U	210U
alpha-BHC	--	--	--	450U	9.9UJ	9.8U	12U	16U	2.1U
alpha-Chlordane	--	--	--	R	31J	12J	12U	16U	2.1U
beta-BHC	--	--	--	450U	9.9UJ	9.8U	12U	16U	2.1U
delta-BHC	--	--	--	450U	9.9UJ	9.8U	12U	16U	2.1U
gamma-BHC (Lindane)	520	2200	50000	450U	9.9UJ	9.8U	12U	16U	2.1U
gamma-Chlordane	--	--	--	1800	22J	9.8U	12U	16U	2.1U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB4	LOS4	LOS8	LOS9	LOS9	LOS10	LOS10	LOS11
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	02	06	04	08	02
				Zone **: LO	LO	SS	LO	LO	LO	LO	LO
				Date: 10/24/94	10/24/94	10/24/94	10/25/94	10/25/94	10/28/94	10/28/94	10/25/94
4,4'-DDD	3000	12000	50000	52	18UJ	3.8UJ	21UJ	18UJ	76J	19U	230
4,4'-DDE	2000	9000	50000	5.4J	18UJ	3.8UJ	21UJ	18UJ	18U	19U	31J
4,4'-DDT	2000	9000	500000	3.5U	18UJ	3.8UJ	21UJ	18UJ	18U	19U	22U
Aldrin	40	170	50000	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
Aroclor-1016	490	2000	50000	35U	180UJ	38UJ	210UJ	180UJ	180U	190U	220U
Aroclor-1221	490	2000	50000	71U	360UJ	77UJ	430UJ	370UJ	370U	390U	440U
Aroclor-1232	490	2000	50000	35U	180UJ	38UJ	210UJ	180UJ	180U	190U	220U
Aroclor-1242	490	2000	50000	35U	180UJ	38UJ	210UJ	180UJ	180U	190U	220U
Aroclor-1248	490	2000	50000	35U	180UJ	38UJ	210UJ	180UJ	180U	190U	220U
Aroclor-1254	490	2000	50000	35U	180UJ	38UJ	210UJ	180UJ	180U	190U	220U
Aroclor-1260	490	2000	50000	35U	180UJ	38UJ	210UJ	180UJ	180U	190U	220U
Dieldrin	42	180	50000	3.8	18UJ	14J	21UJ	18UJ	18U	19U	22U
Endosulfan I	--	--	--	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
Endosulfan II	--	--	--	3.5U	18UJ	3.8UJ	21UJ	18UJ	18U	19U	22U
Endosulfan sulfate	--	--	--	3.5U	18UJ	3.8UJ	21UJ	18UJ	18U	19U	22U
Endrin	17000	310000	50000	3.5U	18UJ	3.8UJ	21UJ	18UJ	18U	19U	22U
Endrin aldehyde	--	--	--	R	18UJ	R	21UJ	18UJ	18U	19U	22U
Endrin ketone	--	--	--	3.5U	18UJ	3.8UJ	21UJ	18UJ	18U	19U	22U
Heptachlor	150	650	50000	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
Heptachlor epoxide	--	--	--	1.8U	9UJ	8.6J	11UJ	9.4UJ	9.5U	9.9U	11U
Methoxychlor	280000	5200000	50000	18U	90UJ	20UJ	110UJ	94UJ	95U	99U	110U
Toxaphene	100	200	50000	180U	900UJ	200UJ	1100UJ	940UJ	950U	990U	1100U
alpha-BHC	--	--	--	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
alpha-Chlordane	--	--	--	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
beta-BHC	--	--	--	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
delta-BHC	--	--	--	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
gamma-BHC (Lindane)	520	2200	50000	1.8U	9UJ	2UJ	11UJ	9.4UJ	9.5U	9.9U	11U
gamma-Chlordane	--	--	--	1.8U	9UJ	4J	11UJ	9.4UJ	9.5U	9.9U	11U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB12	LOS12	LOS13	LOS13FR	LOS13	LOS14
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	02	08	02
				Zone**: LO	LO	LO	LO	LO	LO
				Date: 10/25/94	10/25/94	10/31/94	10/31/94	10/31/94	10/25/94
4,4'-DDD	3000	12000	50000	4.6UJ	26J	19U	19U	19U	4.4UJ
4,4'-DDE	2000	9000	50000	4.6UJ	21UJ	21	20	19U	4.4UJ
4,4'-DDT	2000	9000	500000	4.6UJ	21UJ	19U	19U	19U	R
Aldrin	40	170	50000	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
Aroclor-1018	490	2000	50000	46UJ	210UJ	190U	190U	190U	44UJ
Aroclor-1221	490	2000	50000	94UJ	430UJ	390U	390U	380U	90UJ
Aroclor-1232	490	2000	50000	46UJ	210UJ	190U	190U	190U	44UJ
Aroclor-1242	490	2000	50000	46UJ	210UJ	190U	190U	190U	44UJ
Aroclor-1248	490	2000	50000	46UJ	210UJ	190U	190U	190U	44UJ
Aroclor-1254	490	2000	50000	46UJ	210UJ	190U	190U	190U	44UJ
Aroclor-1260	490	2000	50000	46UJ	210UJ	190U	190U	190U	44UJ
Dieldrin	42	180	50000	4.6UJ	21UJ	19U	19U	19U	4.4UJ
Endosulfan I	--	--	--	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
Endosulfan II	--	--	--	4.6UJ	21UJ	19U	19U	19U	4.4UJ
Endosulfan sulfate	--	--	--	4.6UJ	21UJ	19U	19U	19U	4.4UJ
Endrin	17000	310000	50000	4.6UJ	21UJ	19U	19U	19U	4.4UJ
Endrin aldehyde	--	--	--	4.9J	21UJ	19U	19U	19U	R
Endrin ketone	--	--	--	R	21UJ	19U	19U	19U	4.4UJ
Heptachlor	150	650	50000	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
Heptachlor epoxide	--	--	--	R	11UJ	9.8U	9.8U	9.6U	2.3UJ
Methoxychlor	280000	5200000	50000	24UJ	110UJ	98U	98U	96U	93J
Toxaphene	100	200	50000	240UJ	1100UJ	980U	980U	960U	230UJ
alpha-BHC	--	--	--	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
alpha-Chlordane	--	--	--	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
beta-BHC	--	--	--	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
delta-BHC	--	--	--	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
gamma-BHC (Lindane)	520	2200	50000	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ
gamma-Chlordane	--	--	--	2.4UJ	11UJ	9.8U	9.8U	9.6U	2.3UJ

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: LOSB15	LOSB16	LOSB17	LOSB18	LOSB18	LOSB18FR	MBSB1
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	04	02	02	08	08	02
				Zone **: LO	LO	LO	LO	LO	LO	MB
				Date: 10/24/94	10/25/94	10/24/94	10/24/94	10/24/94	10/24/94	10/25/94
4,4'-DDD	3000	12000	50000	210	18U	3.9U	4.1	22UJ	4.2UJ	19UJ
4,4'-DDE	2000	9000	50000	21J	18U	3.9U	3.8U	22UJ	4.2UJ	19UJ
4,4'-DDT	2000	9000	500000	7.6U	18U	3.9U	3.8U	22UJ	R	19UJ
Aldrin	40	170	50000	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
Aroclor-1018	490	2000	50000	76U	180U	39U	38U	220UJ	42UJ	190UJ
Aroclor-1221	490	2000	50000	160U	370U	79U	76U	440UJ	86UJ	380UJ
Aroclor-1232	490	2000	50000	76U	180U	39U	38U	220UJ	42UJ	190UJ
Aroclor-1242	490	2000	50000	76U	180U	39U	38U	220UJ	42UJ	190UJ
Aroclor-1248	490	2000	50000	76U	180U	39U	38U	220UJ	42UJ	190UJ
Aroclor-1254	490	2000	50000	76U	180U	39U	38U	220UJ	42UJ	190UJ
Aroclor-1260	490	2000	50000	76U	180U	39U	38U	220UJ	42UJ	190UJ
Dieldrin	42	180	50000	24	18U	3.9U	3.8U	22UJ	4.2UJ	19UJ
Endosulfan I	--	--	--	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
Endosulfan II	--	--	--	7.6U	18U	3.9U	3.8U	22UJ	4.2UJ	19UJ
Endosulfan sulfate	--	--	--	7.6U	18U	3.9U	3.8U	22UJ	4.2UJ	19UJ
Endrin	17000	310000	50000	7.6U	18U	3.9U	3.8U	22UJ	4.2UJ	19UJ
Endrin aldehyde	--	--	--	9.3	18U	3.9U	3.8U	22UJ	R	19UJ
Endrin ketone	--	--	--	11J	18U	3.9U	3.8U	22UJ	6.5J	19UJ
Heptachlor	150	650	50000	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
Heptachlor epoxide	--	--	--	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
Methoxychlor	280000	5200000	50000	39U	94U	20U	19U	110UJ	22UJ	97UJ
Toxaphene	100	200	50000	390U	940U	200U	190U	1100UJ	220UJ	970UJ
alpha-BHC	--	--	--	R	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
alpha-Chlordane	--	--	--	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
beta-BHC	--	--	--	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
delta-BHC	--	--	--	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
gamma-BHC (Lindane)	520	2200	50000	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ
gamma-Chlordane	--	--	--	3.9U	9.4U	2U	1.9U	11UJ	2.2UJ	9.7UJ

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: MBSB2	MBSB3	MBSB3	MBSB3FR	MDCBSB2	N2TFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	10	10	03	02
				Zone **: MB	MB	MB	MB	MDC	N2TF
				Date: 10/21/94	10/25/94	10/25/94	10/25/94	10/11/94	10/19/94
4,4'-DDD	3000	12000	50000	7.9J	24UJ	23U	23UJ	3.6U	4.1U
4,4'-DDE	2000	9000	50000	3.8UJ	24U	23U	23UJ	3.6U	48
4,4'-DDT	2000	9000	500000	3.8UJ	R	23U	23UJ	3.6U	54
Aldrin	40	170	50000	2UJ	R	12U	12UJ	1.8U	2.5J
Aroclor-1016	490	2000	50000	38UJ	240UJ	230U	230UJ	36U	41U
Aroclor-1221	490	2000	50000	77UJ	490UJ	470U	460UJ	73U	83U
Aroclor-1232	490	2000	50000	38UJ	240UJ	230U	230UJ	36U	41U
Aroclor-1242	490	2000	50000	38UJ	240UJ	230U	230UJ	36U	41U
Aroclor-1248	490	2000	50000	38UJ	240UJ	230U	230UJ	36U	41U
Aroclor-1254	490	2000	50000	38UJ	240UJ	230U	230UJ	36U	41U
Aroclor-1260	490	2000	50000	38UJ	240UJ	230U	230UJ	36U	41U
Dieldrin	42	180	50000	3.8UJ	R	23U	23UJ	3.6U	4.1U
Endosulfan I	--	--	--	2UJ	12UJ	12U	12UJ	1.8U	2.1U
Endosulfan II	--	--	--	3.8UJ	24UJ	23U	23UJ	3.6U	4.1U
Endosulfan sulfate	--	--	--	3.8UJ	24UJ	23U	23UJ	3.6U	4.1U
Endrin	17000	310000	50000	3.8UJ	R	23U	23UJ	3.6U	4.1U
Endrin aldehyde	--	--	--	3.8UJ	24UJ	23U	23UJ	3.6U	4.1U
Endrin ketone	--	--	--	3.8UJ	24UJ	23U	23UJ	3.6U	4.1U
Heptachlor	150	650	50000	2UJ	R	12U	12UJ	1.8U	2.1U
Heptachlor epoxide	--	--	--	2UJ	12UJ	12U	12UJ	1.8U	2.1U
Methoxychlor	280000	5200000	50000	20UJ	120UJ	120U	26J	18U	21U
Toxaphene	100	200	50000	200UJ	1200UJ	1200U	1200UJ	180U	210U
alpha-BHC	--	--	--	2UJ	12UJ	12U	12UJ	1.8U	2.1U
alpha-Chlordane	--	--	--	2UJ	12UJ	13J	12UJ	1.8U	2.1U
beta-BHC	--	--	--	2UJ	57J	12U	12UJ	1.8U	2.1U
delta-BHC	--	--	--	2UJ	12UJ	12U	12UJ	1.8U	2.1U
gamma-BHC (Lindane)	520	2200	50000	2UJ	R	12U	12UJ	1.8U	2.1U
gamma-Chlordane	--	--	--	2UJ	12UJ	12U	12UJ	1.8U	2.1U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N2TFSB4	N2TFSB4	N2TFSB5	N2TFSB5	N3TFSB1	N3TFSB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	02	06	02	02
				Zone **: N2TF	N2TF	N2TF	N2TF	N3TF	AP
				Date: 10/28/94	10/28/94	10/19/94	10/19/94	10/18/94	10/19/94
4,4'-DDD	3000	12000	50000	R	21U	3.7UJ	3.7U	260	130
4,4'-DDE	2000	9000	50000	22U	21U	3.7UJ	7.7J	39	3.7UJ
4,4'-DDT	2000	9000	500000	22U	21U	3.7UJ	3.7U	R	R
Aldrin	40	170	50000	11U	11U	1.9UJ	1.9U	1.9U	1.9UJ
Aroclor-1016	490	2000	50000	220U	210U	37UJ	37U	37U	37UJ
Aroclor-1221	490	2000	50000	440U	420U	76UJ	76U	75U	76UJ
Aroclor-1232	490	2000	50000	220U	210U	37UJ	37U	37U	37UJ
Aroclor-1242	490	2000	50000	220U	210U	37UJ	37U	37U	37UJ
Aroclor-1248	490	2000	50000	220U	210U	37UJ	37U	37U	37UJ
Aroclor-1254	490	2000	50000	220U	210U	37UJ	37U	37U	45J
Aroclor-1260	490	2000	50000	220U	210U	37UJ	37U	37U	37UJ
Dieldrin	42	180	50000	22U	21U	3.7UJ	3.7U	R	5.9J
Endosulfen I	--	--	--	11U	11U	1.9UJ	1.9U	1.9U	1.9UJ
Endosulfen II	--	--	--	22U	21U	3.7UJ	3.7U	3.7U	3.7UJ
Endosulfen sulfate	--	--	--	24	21U	R	3.7U	3.7U	3.7UJ
Endrin	17000	310000	50000	22U	21U	3.7UJ	3.7U	R	3.7UJ
Endrin aldehyde	--	--	--	R	21U	3.7UJ	3.7U	10J	3.7UJ
Endrin ketone	--	--	--	22U	21U	3.7UJ	3.7U	3.7U	3.7UJ
Heptachlor	150	650	50000	11U	11U	1.9UJ	1.9U	1.9U	1.9UJ
Heptachlor epoxide	--	--	--	11U	11U	R	1.9U	1.9U	1.9UJ
Methoxychlor	280000	5200000	50000	110U	110U	19UJ	120J	230J	19UJ
Toxaphene	100	200	50000	1100U	1100U	190UJ	190U	190U	190UJ
alpha-BHC	--	--	--	11U	11U	1.9UJ	1.9U	R	1.9UJ
alpha-Chlordane	--	--	--	R	11U	1.9UJ	3J	2.8J	1.9UJ
beta-BHC	--	--	--	11U	11U	1.9UJ	5.1J	4.2J	1.9UJ
delta-BHC	--	--	--	11U	11U	1.9UJ	1.9U	1.9U	1.9UJ
gamma-BHC (Lindane)	520	2200	50000	11U	11U	1.9UJ	1.9U	1.9U	1.9UJ
gamma-Chlordane	--	--	--	R	11U	1.9UJ	1.9U	5J	1.9UJ

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB2	N3TFSB2FR	N3TFSB3	N3TFSB4	N3TFSB5	N3TFSB6
	Residential	Non-Residential	Impact to Groundwater	Depth: 06	06	02	02	08	02
				Zone **: AP	AP	N3TF	N3TF	N3TF	N3TF
				Date: 10/19/94	10/19/94	10/13/94	10/17/94	10/19/94	10/18/94
4,4'-DDD	3000	12000	50000	4.5UJ	47J	R	3.9U	3.9U	99
4,4'-DDE	2000	9000	50000	4.5U	21U	39	21J	3.9U	54
4,4'-DDT	2000	9000	500000	4.5U	21U	57J	24J	3.9U	20U
Aldrin	40	170	50000	2.3U	11U	2.1	2U	20J	10U
Aroclor-1016	490	2000	50000	45U	210U	40U	39U	39U	200U
Aroclor-1221	490	2000	50000	91U	430U	81U	79U	79U	400U
Aroclor-1232	490	2000	50000	45U ²	210U	40U	39U	39U	200U
Aroclor-1242	490	2000	50000	45U	210U	40U	39U	39U	200U
Aroclor-1248	490	2000	50000	45U	210U	40U	39U	39U	200U
Aroclor-1254	490	2000	50000	45U	210U	40U	39U	39U	200U
Aroclor-1260	490	2000	50000	45U	210U	40U	39U	39U	200U
Dieldrin	42	180	50000	4.5U	21U	9.1	3.9U	3.9U	20U
Endosulfen I	--	--	--	2.3U	11U	2U	2U	2U	10U
Endosulfen II	--	--	--	20	21U	4U	3.9U	3.9U	20U
Endosulfen sulfate	--	--	--	4.5U	21U	4U	3.9U	3.9U	20U
Endrin	17000	310000	50000	4.5U	21U	4U	3.9U	3.9U	20U
Endrin aldehyde	--	--	--	4.5U	21U	4U	3.9U	3.9U	20U
Endrin ketone	--	--	--	8.8J	21U	4U	3.9U	3.9U	20U
Heptachlor	150	650	50000	2.3U	11U	2U	R	2U	10U
Heptachlor epoxide	--	--	--	2.3U	11U	2U	2U	2U	10U
Methoxychlor	280000	5200000	50000	23U	110U	20U	20U	20U	100U
Toxaphene	100	200	50000	230U	1100U	200U	200U	200U	1000U
alpha-BHC	--	--	--	2.3U	11U	2U	2U	2U	10U
alpha-Chlordane	--	--	--	2.3U	11U	2U	R	R	10U
beta-BHC	--	--	--	2.3U	11U	2U	2U	2U	10U
delta-BHC	--	--	--	2.3U	11U	2U	2U	2U	10U
gamma-BHC (Lindane)	520	2200	50000	2.3U	11U	2U	2U	2U	10U
gamma-Chlordane	--	--	--	2.3U	11U	7.9J	2U	2U	10U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: N3TFSB7	N3TFSB8	N3TFSB8	N3TFSB9	PN1SB2	PN1SB2
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	02	06	02	04	08
				Zone **: N3TF	N3TF	N3TF	N3TF	P1	P1
				Date: 10/18/94	10/18/94	10/18/94	11/02/94	11/02/94	11/02/94
4,4'-DDD	3000	12000	50000	35J	19U	4UJ	240J	26	19U
4,4'-DDE	2000	9000	50000	62J	22	4.3J	260	18U	19U
4,4'-DDT	2000	9000	500000	4.1U	19U	4UJ	290J	18U	19U
Aldrin	40	170	50000	41J	10U	2.1UJ	11U	9.5U	9.9U
Aroclor-1016	490	2000	50000	41U	190U	40UJ	210U	180U	190U
Aroclor-1221	490	2000	50000	83U	390U	81UJ	420U	370U	390U
Aroclor-1232	490	2000	50000	41U	190U	40UJ	210U	180U	190U
Aroclor-1242	490	2000	50000	41U	190U	40UJ	210U	180U	190U
Aroclor-1248	490	2000	50000	41U	190U	40UJ	210U	180U	190U
Aroclor-1254	490	2000	50000	41U	190U	40UJ	210U	180U	190U
Aroclor-1260	490	2000	50000	41U	190U	40UJ	210U	180U	190U
Dieldrin	42	180	50000	4.1U	19U	4UJ	21U	18U	19U
Endosulfan I	--	--	--	2.1U	10U	2.1UJ	11U	9.5U	9.9U
Endosulfan II	--	--	--	4.1U	19U	4UJ	21U	18U	19U
Endosulfan sulfate	--	--	--	4.1U	19U	4UJ	21U	18U	19U
Endrin	17000	310000	50000	4.1U	19U	4UJ	21U	26J	19U
Endrin aldehyde	--	--	--	4.1U	19U	4UJ	21U	18U	19U
Endrin ketone	--	--	--	R	19U	4UJ	21U	18U	19U
Heptachlor	150	650	50000	2.1U	10U	2.1UJ	11U	9.5U	9.9U
Heptachlor epoxide	--	--	--	2.1U	10U	2.1UJ	11U	9.5U	9.9U
Methoxychlor	280000	5200000	50000	21U	100U	21UJ	110U	95U	99U
Toxaphene	100	200	50000	210U	1000U	210UJ	1100U	950U	990U
alpha-BHC	--	--	--	2.1U	10U	2.1UJ	11U	9.5U	9.9U
alpha-Chlordane	--	--	--	R	10U	3.1J	11U	9.5U	9.9U
beta-BHC	--	--	--	R	10U	2.1UJ	11U	9.5U	9.9U
delta-BHC	--	--	--	R	10U	2.1UJ	11U	9.5U	9.9U
gamma-BHC (Lindane)	520	2200	50000	2.1U	10U	2.1UJ	11U	9.5U	9.9U
gamma-Chlordane	--	--	--	23J	10U	2.1UJ	11U	9.5U	9.9U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: PSSB1	PSSB1	SSB1	SSB3	SSB3	STFSB1	STFSB1
	Residential	Non-Residential	Impact to Groundwater	Depth: 02	06	16	06	10	02	06
				Zone **: MB	MB	SS	SS	SS	STF	STF
				Date: 10/31/94	10/31/94	10/24/94	10/24/94	10/24/94	10/26/94	10/26/94
4,4'-DDD	3000	12000	50000	7.2	19U	3.8UJ	27UJ	4.3UJ	3.8UJ	22U
4,4'-DDE	2000	9000	50000	3.8U	19U	R	27UJ	4.3UJ	3.8UJ	22U
4,4'-DDT	2000	9000	500000	3.8U	19U	3.8UJ	27UJ	4.3UJ	3.8UJ	22U
Aldrin	40	170	50000	2U	9.9U	2UJ	14UJ	2.2UJ	1.9UJ	11U
Aroclor-1016	490	2000	50000	38U	190U	38UJ	270UJ	43UJ	38UJ	220U
Aroclor-1221	490	2000	50000	78U	390U	78UJ	550UJ	88UJ	77UJ	450U
Aroclor-1232	490	2000	50000	38U	190U	38UJ	270UJ	43UJ	38UJ	220U
Aroclor-1242	490	2000	50000	38U	190U	38UJ	270UJ	43UJ	38UJ	220U
Aroclor-1248	490	2000	50000	38U	190U	38UJ	270UJ	43UJ	38UJ	220U
Aroclor-1254	490	2000	50000	38U	190U	38UJ	270UJ	43UJ	38UJ	220U
Aroclor-1260	490	2000	50000	38U	190U	38UJ	270UJ	43UJ	38UJ	220U
Dieldrin	42	180	50000	3.8U	19U	15J	27UJ	4.3UJ	3.8UJ	22U
Endosulfan I	--	--	--	2U	9.9U	R	14UJ	2.2UJ	18J	11U
Endosulfan II	--	--	--	3.8U	19U	3.8UJ	27UJ	4.3UJ	3.8UJ	22U
Endosulfan sulfate	--	--	--	3.8U	19U	3.8UJ	27UJ	4.3UJ	24J	22U
Endrin	17000	310000	50000	3.8U	19U	3.8UJ	13J	4.3UJ	10J	22U
Endrin aldehyde	--	--	--	3.8U	19U	3.8UJ	9J	4.3UJ	3.8UJ	22U
Endrin ketone	--	--	--	3.8U	19U	3.8UJ	69J	R	7.4J	22U
Heptachlor	150	650	50000	2U	9.9U	2UJ	14UJ	2.2UJ	1.9UJ	11U
Heptachlor epoxide	--	--	--	2U	9.9U	2UJ	14UJ	16J	1.9UJ	11U
Methoxychlor	280000	5200000	50000	20U	99U	20UJ	1500J	22UJ	19UJ	110U
Toxaphene	100	200	50000	200U	990U	200UJ	1400UJ	220UJ	190UJ	1100U
alpha-BHC	--	--	--	2U	9.9U	2UJ	14UJ	2.2UJ	1.9UJ	11U
alpha-Chlordane	--	--	--	2U	9.9U	2UJ	14UJ	2.2UJ	1.9UJ	11U
beta-BHC	--	--	--	2U	9.9U	2UJ	14UJ	2.2UJ	1.9UJ	11U
delta-BHC	--	--	--	2U	9.9U	2UJ	14UJ	2.2UJ	1.9UJ	11U
gamma-BHC (Lindane)	520	2200	50000	2U	9.9U	2UJ	14UJ	2.2UJ	1.9UJ	11U
gamma-Chlordane	--	--	--	2U	9.9U	2UJ	14UJ	R	1.9UJ	11U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: STFSB2	FBNA1-100594	FBNA5-101994	FBNA6-102094	FBNA7-102594
	Residential	Non-Residential	Impact to Groundwater	Depth: 08 Zone **: STF Date: 10/26/94	10/05/94	10/19/94	10/20/94	10/25/94
4,4'-DDD	3000	12000	50000	21U	0.1U	0.1U	0.1U	0.1U
4,4'-DDE	2000	9000	50000	21U	0.1U	0.1U	0.1U	0.1U
4,4'-DDT	2000	9000	500000	R	0.1U	0.1U	0.1U	0.1U
Aldrin	40	170	50000	11U	0.05U	0.05U	0.05U	0.05U
Aroclor-1016	490	2000	50000	210U	1U	1U	1U	1U
Aroclor-1221	490	2000	50000	430U	2U	2U	2U	2U
Aroclor-1232	490	2000	50000	210U	1U	1U	1U	1U
Aroclor-1242	490	2000	50000	210U	1U	1U	1U	1U
Aroclor-1248	490	2000	50000	210U	1U	1U	1U	1U
Aroclor-1254	490	2000	50000	210U	1U	1U	1U	1U
Aroclor-1280	490	2000	50000	210U	1U	1U	1U	1U
Dieldrin	42	180	50000	21U	0.1U	0.1U	0.1U	0.1U
Endosulfan I	--	--	--	11U	0.05U	0.05U	0.05U	0.05U
Endosulfan II	--	--	--	21U	0.1U	0.1U	0.1U	0.1U
Endosulfan sulfate	--	--	--	21U	0.1U	0.1U	0.1U	0.1U
Endrin	17000	310000	50000	21U	0.1U	0.1U	0.1U	0.1U
Endrin aldehyde	--	--	--	22	0.1U	0.1U	0.1U	0.1U
Endrin ketone	--	--	--	21U	0.1U	0.1U	0.1U	0.1U
Heptachlor	150	650	50000	11U	0.05U	0.05U	0.05U	0.05U
Heptachlor epoxide	--	--	--	11U	0.05U	0.05U	0.05U	0.05U
Methoxychlor	280000	5200000	50000	110U	0.5U	0.5U	0.5U	0.5U
Toxaphene	100	200	50000	1100U	5U	5U	5U	5U
alpha-BHC	--	--	--	11U	0.05U	0.05U	0.05U	0.05U
alpha-Chlordane	--	--	--	30J	0.05U	0.05U	0.05U	0.05U
beta-BHC	--	--	--	11U	0.0081J	0.05U	0.05U	0.05U
delta-BHC	--	--	--	11U	0.05U	0.05U	0.05U	0.05U
gamma-BHC (Lindane)	520	2200	50000	11U	0.05U	0.05U	0.05U	0.05U
gamma-Chlordane	--	--	--	11U	0.05U	0.05U	0.05U	0.05U

See last page for footnotes.



Table 5-4. Pesticide and Polychlorinated Biphenyl Compounds in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/kg)	NJDEP Soil Cleanup Criteria *			Sample ID: FBNA9-102694	FBNA11-102794	FBNA13-102894	FBNA14-102894	FBNA17-103194
	Residential	Non-Residential	Impact to Groundwater	Zone **: Date: 10/26/94	10/27/94	10/28/94	10/28/94	10/31/94
4,4'-DDD	3000	12000	50000	0.1U	0.1U	0.1U	0.1U	0.1U
4,4'-DDE	2000	9000	50000	0.1U	0.1U	0.1U	0.1U	0.1U
4,4'-DDT	2000	9000	500000	0.1U	0.1U	0.1U	0.1U	0.1U
Aldrin	40	170	50000	0.05U	0.05U	0.05U	0.05U	0.05U
Aroclor-1016	490	2000	50000	1U	1U	1U	1U	1U
Aroclor-1221	490	2000	50000	2U	2U	2U	2U	2U
Aroclor-1232	490	2000	50000	1U	1U	1U	1U	1U
Aroclor-1242	490	2000	50000	1U	1U	1U	1U	1U
Aroclor-1248	490	2000	50000	1U	1U	1U	1U	1U
Aroclor-1254	490	2000	50000	1U	1U	1U	1U	1U
Aroclor-1260	490	2000	50000	1U	1U	1U	1U	1U
Dieldrin	42	180	50000	0.1U	0.1U	0.1U	0.1U	0.1U
Endosulfan I	--	--	--	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan II	--	--	--	0.1U	0.1U	0.1U	0.1U	0.1U
Endosulfan sulfate	--	--	--	0.1U	0.1U	0.1U	0.1U	0.1U
Endrin	17000	310000	50000	0.1U	0.1U	0.1U	0.1U	0.1U
Endrin aldehyde	--	--	--	0.1U	0.1U	0.1U	0.1U	0.1U
Endrin ketone	--	--	--	0.1U	0.1U	0.1U	0.1U	0.1U
Heptachlor	150	650	50000	0.05U	0.05U	0.05U	0.05U	0.05U
Heptachlor epoxide	--	--	--	0.05U	0.05U	0.05U	0.05U	0.05U
Methoxychlor	280000	5200000	50000	0.5U	0.5U	0.5U	0.5U	0.5U
Toxaphene	100	200	50000	5U	5U	5U	5U	5U
alpha-BHC	--	--	--	0.05U	0.05U	0.05U	0.05U	0.05U
alpha-Chlordane	--	--	--	0.05U	0.05U	0.05U	0.05U	0.05U
beta-BHC	--	--	--	0.05U	0.05U	0.05U	0.05U	0.05U
delta-BHC	--	--	--	0.05U	0.05U	0.05U	0.05U	0.05U
gamma-BHC (Lindane)	520	2200	50000	0.05U	0.05U	0.05U	0.05U	0.05U
gamma-Chlordane	--	--	--	0.05U	0.05U	0.05U	0.05U	0.05U

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per kilogram (ug/kg) (equivalent to parts per billion [ppb]).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP)

protocols contained in the Statement of Work (SOW) OLM01.8 and New Jersey modified 418.1 for total petroleum hydrocarbon (TPH).

Sample results exceeding the NJDEP impact to groundwater criteria are shown in bold. Sample results exceeding the NJDEP non-residential criteria are underlined.

Sample results exceeding both criteria are shown in bold and underlined.

NJDEP New Jersey Department of Environmental Protection.

FBNA Indicates a field blank associated with non-aqueous samples.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specific detection limit.

J Estimated result.

R Rejected result.

-- No applicable criteria.

* NJDEP Soil Cleanup Criteria, February 3, 1992; last revised February 3, 1994.

** Zones as defined in Table 3-2.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: 3TFIRMB4	3TFIRMB4	AGTFSB1	AGTFSB1	AGTFSB2	AGTFSB3	AGTFSB4
	Residential	Non-Residential	Depth: 02	06	02	06	04	02	02
			Zone **: N3TF	N3TF	AGTF	AGTF	AGTF	AGTF	AGTF
			Date: 10/17/94	10/17/94	10/20/94	10/20/94	10/28/94	10/27/94	10/20/94
Aluminum	--	--	12100	1710	3290J	1810J	4750	7500	3030
Antimony	14	340	17.4J	4.5J	2.40J	59.7J	0.320J	7.9J	2.7J
Arsenic	20	20	10.7	<u>37.3</u>	12.2	<u>237</u>	5J	<u>27.9J</u>	<u>27</u>
Berium	700	47000	59.5	73.4	36.7J	49J	34.1J	75.5	67.9
Beryllium	1	1	0.27J	0.23U	0.3J	0.05U	0.64J	<u>2</u>	<u>1.4</u>
Cadmium	1	100	R	0.25U	0.35J	0.08U	0.48J	R	R
Calcium	--	--	40700J	1830J	2400J	478J	2050	19100	3370J
Cobalt	--	--	54	35.8	6.5J	4.5J	14.5	26.8	18.3
Copper	600	600	63.3J	<u>712</u>	84J	264J	175J	156J	354
Cyanide	1100	21000	0.6U	0.59U	0.65U	0.65U	0.57U	0.6U	0.6U
Iron	--	--	36700	8190	12800	13100	18900	46600	25000
Lead	400	600	158	55.8	293J	<u>792J</u>	170	<u>5150</u>	473
Magnesium	--	--	19700	710J	1210J	289J	1680	7150	1610
Manganese	--	--	322	43	59.1J	12.1J	132	309	255
Mercury	14	270	0.55	0.17	0.89	0.99	0.17J	0.53J	0.59
Nickel	250	2400	263	<u>2650</u>	32.1J	15.5J	111	140	94.7
Potassium	--	--	798J	240J	507J	500J	893J	751J	477J
Selenium	63	3100	0.770J	3.2	1.3	4.3	1.2	0.820J	1J
Silver	110	4100	0.54U	0.81J	0.13U	0.53J	0.11U	0.28J	0.56U
Sodium	--	--	R	151U	362U	685U	283U	345U	5490J
Thallium	2	2	10J	10J	0.78U	<u>3.4</u>	0.68U	0.720J	10J
Vanadium	370	7100	288	14.8	46.1J	10.5J	33.5	171	62.3J
Zinc	1500	1500	131	93.5	145J	158J	333J	373J	933

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: AHTFSB1	AHTFSB2	AHTFSB4	AHTFSB4	APSB2	APSB5	APSB5	APSB6
	Residential	Non-Residential	Depth: 02	02	02	08	02	02	06	06
			Zone**: AHTF	AHTF	AHTF	AHTF	AP	AP	AP	AP
			Date: 10/19/94	10/14/94	10/14/94	10/14/94	10/26/94	10/12/94	10/12/94	10/21/94
Aluminum	--	--	3730	4820	4190	6710	4000J	9840	1910	2550J
Antimony	14	340	0.26UJ	0.61J	0.41J	2.7J	1.6J	4.1J	0.64J	0.77J
Arsenic	20	20	9	12.9	<u>23.3</u>	<u>88.8</u>	18.4J	7.7	13.5	<u>35.1J</u>
Barium	700	47000	39.7J	63.8	32.6J	65.6	74	96.5	41.4J	103
Beryllium	1	1	0.42J	0.34J	0.21J	0.28J	0.24J	0.36J	0.21J	0.17J
Cadmium	1	100	0.17U	R	0.07UJ	0.12J	0.07UJ	R	0.15J	R
Calcium	--	--	469J	618J	1450J	1040J	5310J	21400	1340J	3070J
Cobalt	--	--	4.6J	4.9J	5.4J	6.5J	7J	24.1	7.9J	7J
Copper	600	600	100	445J	60.1J	89J	234J	84.2	65.1J	461J
Cyanide	1100	21000	0.54U	0.58U	0.56U	0.57U	0.58U	0.53U	0.64U	0.55U
Iron	--	--	15800	23400	20200	13600	15400	23000	19200	38000
Lead	400	600	260	512	93.6	156	197J	184	116	416J
Magnesium	--	--	784J	1020J	1150	1950	1350J	6150	611J	4360J
Manganese	--	--	54.5	94.3	81.5	64.2	266	250J	63.2	161
Mercury	14	270	0.12	0.55	0.11U	0.75	0.29	0.29J	1	1.7
Nickel	250	2400	17.9	18.7	13.7	54.2	34.9J	87.1	51.3	62.7J
Potassium	--	--	675J	581J	540J	1110J	568J	882J	263J	585J
Selenium	63	3100	1J	0.78UJ	0.76UJ	0.78UJ	0.79U	0.59UJ	1.5J	1.5J
Silver	110	4100	0.52U	0.55U	0.53U	0.55U	0.12J	0.19J	0.61U	0.17J
Sodium	--	--	203U	R	258U	425U	225U	1210J	456U	780J
Thallium	2	2	0.97UJ	1UJ	1U	1U	0.7U	0.63UJ	1.1U	0.67UJ
Vanadium	370	7100	20	22J	23.2	25.2	41J	112	102	95.1J
Zinc	1500	1500	89	224	43	82.4	48.2	159	124	562

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: APSB6	DTSB3	DTSB3FR	ECIRMB1	ECIRMB3	ECIRMB3	ECPSB1	ECPSB2
	Residential	Non-Residential	Depth: 10	04	04	02	02	06	02	06
			Zone **: AP	DT	DT	U	N3TF	N3TF	ECP	ECP
			Date: 10/21/94	10/27/94	10/27/94	10/24/94	10/19/94	10/19/94	10/20/94	10/20/94
Aluminum	--	--	1320J	5310J	3800J	787J	6500	608J	2110J	649J
Antimony	14	340	2.7J	0.72J	R	0.28UJ	4.7J	4.9J	2.7UJ	3UJ
Arsenic	20	20	<u>63.3J</u>	16.5J	7J	4.3	<u>48.2</u>	<u>92.9</u>	<u>39.5</u>	<u>71.5</u>
Barium	700	47000	56.1	76.7J	45.5J	9.4J	85.2	25.2J	60.4	6J
Beryllium	1	1	0.14J	0.36J	0.22J	0.47J	0.45J	0.03U	0.19J	0.08U
Cadmium	1	100	0.08UJ	0.28J	0.07UJ	0.07U	R	0.08U	0.36J	0.07U
Calcium	--	--	883J	1480J	1620J	254J	5100J	656J	1880J	307J
Cobalt	--	--	6.5J	29.3J	77.5J	2.1J	16.1	8.2J	4.4J	5J
Copper	600	600	159J	472J	<u>1220J</u>	17.7J	153	332J	<u>1490J</u>	193J
Cyanide	1100	21000	0.65U	0.61UJ	0.61UJ	0.58U	0.58U	0.66U	0.58U	0.58U
Iron	--	--	5460	15200J	7850J	2940	27100	21200	12700	9580
Lead	400	600	532J	129J	59.4J	122J	525	25.3J	380J	25.6J
Magnesium	--	--	318J	2800J	1090J	106J	3660	129J	545J	53.9J
Manganese	--	--	75.9	352J	187J	14.7J	219	113J	97.8J	48J
Mercury	14	270	0.56	0.81J	0.34J	0.12U	1.7	0.13U	0.92	0.24
Nickel	250	2400	92.8J	197J	520J	19.4J	79.7	62.3J	30.9J	34.6J
Potassium	--	--	288U	1120J	895J	136UJ	1130J	286J	439J	159UJ
Selenium	63	3100	2	1.3J	2.3J	0.79U	1.1J	0.88U	1.4	0.77U
Silver	110	4100	0.16J	0.44J	0.5J	0.12U	0.53U	0.17J	0.47J	0.11U
Sodium	--	--	464U	1510J	4340J	202U	R	330U	638U	287U
Thallium	2	2	0.77U	0.73UJ	0.73UJ	0.7U	1UJ	0.78U	0.68U	0.68U
Vanadium	370	7100	18.6J	62.8J	35.6J	51.1J	157	11.7J	24.4J	10.1J
Zinc	1500	1500	71.4	549J	58J	27.1J	421	45.4J	116J	475J

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: ECPSB2	ECPSB4	ECPSB5	GFSB1	GTFIRMB1	GTFIRMB1	GTFIRMB2
	Residential	Non-Residential	Depth: 12	08	02	02	02	08	02
			Zone **: ECP	ECP	ECP	STF	GTF	GTF	GTF
			Date: 10/20/94	10/19/94	10/19/94	10/12/94	10/08/94	10/08/94	10/17/94
Aluminum	--	--	2430J	3870J	3560	23300	7900	19000	5470
Antimony	14	340	42.5J	0.29UJ	1.8J	4.1J	1.6J	0.29UJ	2.3J
Arsenic	20	20	207J	11	38.3	46.7	8.5	1.6J	8.1
Barium	700	47000	93	54.9	99.8	170	108	105	121
Beryllium	1	1	.07J	0.23J	0.22U	0.91J	0.34J	0.69J	0.36J
Cadmium	1	100	.08UJ	0.07U	R	R	0.46J	0.07UJ	0.81J
Calcium	--	--	471J	20300J	4520J	6930	6820	6270	19400J
Cobalt	--	--	5.5J	4.6J	8.8J	397	37.5	642	10.9J
Copper	600	600	284J	214J	110	1330	170	1510	74.3J
Cyanide	1100	21000	.7U	0.59U	0.66	0.57U	0.55U	0.82U	0.57U
Iron	--	--	12200	10100	24600	30900	18400	22300	20900
Lead	400	600	256J	78.8J	279	324	153	11	241
Magnesium	--	--	392J	3060J	2470	6320	4290	4440	4290
Manganese	--	--	16.2	71.4J	107	281J	237J	312J	454
Mercury	14	270	2	0.12U	0.5	1.3J	0.45J	0.11U	0.87
Nickel	250	2400	21.2J	70.9J	43	909	153	1520	74.9
Potassium	--	--	712J	1630J	649J	5090	1330	4120	983J
Selenium	63	3100	2.8	0.93J	1.3J	2.4J	0.61UJ	1.8J	0.76UJ
Silver	110	4100	.39J	0.16J	0.54U	0.56J	0.24J	0.41J	0.53U
Sodium	--	--	769J	6800	250UJ	36300J	4100J	35400J	535U
Thallium	2	2	2.7J	0.71U	1UJ	0.67UJ	0.65UJ	0.73UJ	1U
Vanadium	370	7100	14.8J	368J	62.9	93.6	55.8	30.2	158
Zinc	1500	1500	113	41.7J	133	167	179	47.4J	173

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: GTFIRMB2	GTFIRMB3	GTFIRMB3	GTFIRMB4	GTFIRMB4	GTFIRMB5
			Depth: 08	02	10	02	08	02
			Zone **: GTF	GTF	GTF	GTF	GTF	GTF
	Residential	Non-Residential	Date: 10/17/94	10/05/94	10/05/94	10/17/94	10/17/94	10/05/94
Aluminum	--	--	1490	9100	2180	9200	3510	6190
Antimony	14	340	0.32UJ	2.1J	0.32UJ	9.5J	0.28UJ	4.6J
Arsenic	20	20	<u>33.9</u>	15.5	<u>28.2</u>	10.1	5.2J	11.8
Barium	700	47000	39.9J	145	42J	50.6	24.5J	297
Beryllium	1	1	0.27U	0.48J	0.13J	0.22J	0.18U	0.43J
Cadmium	1	100	0.08U	0.66J	0.08UJ	R	0.16U	1.4
Calcium	--	--	1160J	4560	1280J	27700J	936J	5830J
Cobalt	--	--	3J	82.3	8.3J	51.9	28.5	7.8J
Copper	600	600	49.1	343	47.8	99.8J	265	250
Cyanide	1100	21000	0.68U	0.55U	0.68U	0.6U	0.6U	0.67
Iron	--	--	7370	19800	26700	29800	7950	19600
Lead	400	600	14.9	437	88.1	117	54.7	<u>1180</u>
Magnesium	--	--	334J	2990	485J	13600	993J	2320
Manganese	--	--	45.2	189J	53.9J	311	65	226J
Mercury	14	270	0.27	0.82J	0.13U	0.25	0.16	1.5J
Nickel	250	2400	15	256	33.7	200	421	49.9
Potassium	--	--	300J	1740	490J	803J	707J	1120J
Selenium	63	3100	0.9U	0.74J	1.4J	0.82UJ	0.8U	1.5J
Silver	110	4100	0.64U	0.28J	0.11U	0.58U	0.56U	1.2J
Sodium	--	--	357U	6920J	728UJ	3030J	3120	783UJ
Thallium	2	2	1.2UJ	0.66UJ	0.81UJ	1.1UJ	1.1UJ	0.74UJ
Vanadium	370	7100	12.3J	193	45.3	223	14.8	80.9
Zinc	1500	1500	17.9J	268	30.4J	126	93.9	535

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: GTFIRMB5FR	GTFIRMB5	GTFIRMB6	GTFIRMB6	GTFIRMB7	GTFIRMB7
	Residential	Non-Residential	Depth: 02	08	04	08	02	08
			Zone **: GTF	GTF	GTF	GTF	GTF	GTF
			Date: 10/05/94	10/05/94	10/05/94	10/05/94	10/17/94	10/17/94
Aluminum	--	--	5670	3840	8890	6340	4360	3770
Antimony	14	340	2.6J	1.6J	1.1J	4J	4.5J	9.8J
Arsenic	20	20	11.3	4.6J	10.3	<u>22.5</u>	12.5	12
Barium	700	47000	279	138	232	5290	324	417
Beryllium	1	1	0.41J	0.15J	0.35J	0.58U	0.32J	0.48J
Cadmium	1	100	1.4	0.96J	1.1J	4.7	R	1.1J
Calcium	--	--	10900J	8000	9710	5340	4670J	14600J
Cobalt	--	--	8.2J	5.2J	5.8J	15.2	8.5J	4.6J
Copper	600	800	244	69	186	281	221J	542
Cyanide	1100	21000	0.66	0.66U	0.85	1.9	0.87	1.7
Iron	--	--	19600	11900	25100	24500	29800	12100
Lead	400	600	<u>904</u>	311	<u>5110</u>	<u>7590</u>	<u>1040</u>	<u>1730</u>
Magnesium	--	--	1920	1510	1940	1830	1760	1000J
Manganese	--	--	179J	80.6J	220J	295J	263	98
Mercury	14	270	2.3J	0.69J	0.73J	3.4J	1.9	1.1
Nickel	250	2400	38.2	22.7	36	104	28.3	19.3
Potassium	--	--	966J	539J	912J	1040	567J	604J
Selenium	63	3100	1.5J	2.2J	2J	9.3J	1.8J	3.8
Silver	110	4100	1J	0.41J	0.73J	1.3J	1.3J	2.1J
Sodium	--	--	885J	853UJ	1240J	1510J	R	587U
Thallium	2	2	0.76UJ	0.79UJ	0.86UJ	0.82UJ	1UJ	1.1UJ
Vanadium	370	7100	69.1	48.6	30.8	42.6	44.4J	22.9
Zinc	1500	1500	501	334	360	<u>3210</u>	618	429

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey. .

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: GTFIRMB8	GTFIRMB8	GTFIRMB9	GTFIRMB9	GTFSB1	GTFSB1	GTFSB2
	Residential	Non-Residential	Depth: 02	08	02	06	02	08	02
			Zone **: GTF	GTF	GTF	GTF	GTF	GTF	GTF
			Date: 10/18/94	10/18/94	10/05/94	10/05/94	10/10/94	10/10/94	10/13/94
Aluminum	--	--	3350	3840	4830	4330	4620	4080	3790
Antimony	14	340	11.7J	239J	12.6J	14J	3.6J	1.2J	4.9J
Arsenic	20	20	<u>30.7</u>	<u>24.5</u>	<u>42.2</u>	<u>37.5</u>	10.6	11.8	10.9
Barium	700	47000	501	259	899	593	297	290	277
Beryllium	1	1	0.39J	0.36J	0.43J	0.39J	0.42J	0.44J	0.5J
Cadmium	1	100	6.1	3.1	R	18.4J	R	0.43J	1.2J
Calcium	--	--	4080J	2940J	8910	9150	3510	4580	2420J
Cobalt	--	--	9.5J	7.7J	9J	13.7J	9.9J	8.4J	7.8J
Copper	600	600	421	483J	588	511	<u>662</u>	135	237J
Cyanide	1100	21000	0.91	0.85U	0.82U	0.84U	0.84	0.78	0.82U
Iron	--	--	104000	24000	45500	58300	34000	23400	19700
Lead	400	600	<u>1360</u>	<u>2410</u>	<u>2710</u>	<u>2410</u>	<u>787</u>	544	<u>790</u>
Magnesium	--	--	736J	859J	2290	1200J	2970	470J	1900
Manganese	--	--	293	145	474J	422J	214J	127J	123
Mercury	14	270	1.8	2.9	6J	5.1J	1.3J	0.54J	3
Nickel	250	2400	48.8	43.1	54	162	59.5	27.3	48.8
Potassium	--	--	600J	635J	802J	786J	789J	542J	795J
Selenium	63	3100	5.4J	3J	3J	5J	1.8J	7.9J	1.6J
Silver	110	4100	2.7U	4.5	3	2.5J	0.95J	1.3J	0.93J
Sodium	--	--	612U	423U	R	1450J	R	505UJ	1720
Thallium	2	2	5UJ	1.1U	0.74UJ	1UJ	0.72UJ	0.86UJ	1.1U
Vanadium	370	7100	30.1J	48.8	92.3J	400	43.9J	30.1	42.3
Zinc	1500	1500	1400	1010	<u>1510</u>	<u>8080</u>	674	631	561

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: GTFSB3	GTFSB4	GTFSB5	GTFSB6	GTFSB7	GTFSB7	GTFSB8	GTFSB8
			Depth: 02	02	02	02	02	08	04	08
			Zone **: GTF	GTF	GTF	GTF	GTF	GTF	GTF	GTF
	Residential	Non-Residential	Date: 10/10/94	10/13/94	10/13/94	10/11/94	10/13/94	10/13/94	10/13/94	10/13/94
Aluminum	--	--	3080	6150	10300	2600	5440	3110	3260	7380
Antimony	14	340	1.5J	2.6J	0.27J	1.7J	2.1J	1.4J	0.31J	0.32UJ
Arsenic	20	20	6.9	13.9	9	7.2	7.9	4.2	10.2	3.1
Barium	700	47000	123	247	56.8	158	207	346	30.9J	32.4J
Beryllium	1	1	0.27J	0.46J	0.54J	0.27J	<u>1.3</u>	0.29J	0.22J	0.47J
Cadmium	1	100	0.35J	R	R	0.44J	R	0.3J	R	0.08UJ
Calcium	--	--	2230	4150	3610	2990	4950J	12700J	862J	1250J
Cobalt	--	--	7.4J	45	21.1	6.5J	16.3	5.2J	20.5	66.3
Copper	600	600	74	340	29.4	115	197J	399J	67.5J	138J
Cyanide	1100	21000	0.83	1.2	0.54U	2.2	0.57U	0.68U	0.57U	0.67U
Iron	--	--	17000	23700	38800	11800	26000	18400	39100	14700
Lead	400	600	333	<u>714</u>	34.3	392	404	492	69.1	64.9
Magnesium	--	--	449J	8960	28100	547J	3030	846J	964J	2360
Manganese	--	--	79.6J	419J	390J	79.3J	237	83.8	212	129
Mercury	14	270	0.44J	1.9J	0.14J	1.1J	3	2.4	0.1U	0.13U
Nickel	250	2400	35.3	181	312	24.2	75.1	18.5	50.7	104
Potassium	--	--	703J	1460	6100	495J	449J	527J	689J	1800J
Selenium	63	3100	1.1J	0.83J	0.8UJ	1.4J	1.2J	1.7J	0.78UJ	0.91UJ
Silver	110	4100	0.39J	1.1J	0.09U	0.6J	1.5J	0.65U	0.55U	0.65U
Sodium	--	--	209UJ	4490J	R	295UJ	R	643U	648UJ	3350
Thallium	2	2	0.71UJ	0.68UJ	0.65UJ	0.68UJ	1UJ	1.2U	1UJ	1.2U
Vanadium	370	7100	44.9	101	60.6J	62.4	42.8J	35.7	50.9J	31.5
Zinc	1500	1500	274	398	99.1	196	545	288	117	52.7

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: GTFSB9	GTFSB9	LAIRMB1	LOSB1	LOSB1	LOSB2	LOSB2	LOSB3
	Residential	Non-Residential	Depth: 02	08	02	04	08	04	08	02
			Zone**: GTF	GTF	LO	LO	LO	LO	LO	LO
			Date: 10/13/94	10/13/94	10/24/94	10/25/94	10/25/94	10/14/94	10/14/94	10/24/94
Aluminum	--	--	5380	1070	4710J	652	335U	19000	5980	3740J
Antimony	14	340	2J	3.4J	3.8J	1.2UJ	0.27UJ	4.6J	8.1J	0.98UJ
Arsenic	20	20	5.1	5.1	<u>52.3</u>	12.7J	12.9J	<u>54.8</u>	<u>138</u>	<u>49.9</u>
Barium	700	47000	62.2	35J	259	26J	29.1J	302	141	63.4
Beryllium	1	1	0.22J	0.15J	0.35J	0.02U	0.02U	0.98J	0.17J	0.23J
Cadmium	1	100	0.08J	0.07UJ	R	0.07U	0.07U	16.6	0.2J	0.78J
Calcium	--	--	8140J	1190J	2250J	780J	343U	4890J	21500J	1180J
Cobalt	--	--	81.9	12	10.9J	1.2J	3J	15.9	10.7J	7.7J
Copper	600	600	272J	476J	256J	23.7J	70.2J	322J	78.2J	106J
Cyanide	1100	21000	0.55U	0.58U	0.66U	0.58U	0.57U	0.7U	0.92U	0.61U
Iron	--	--	13000	5230	69200J	1940U	1910U	21900	13500	15100
Lead	400	600	97.2	217	520J	71.6	24.2	<u>640</u>	125	122J
Magnesium	--	--	2190	373J	2780J	546J	188J	3280	758J	718J
Manganese	--	--	152	25.9	247J	16.6U	8.6U	96.3	42	97.7J
Mercury	14	270	0.23	0.12	2	0.12UJ	0.1J	5.5	0.18U	.8
Nickel	250	2400	248	302	59.6J	2.4J	5.6J	72.4	18.9	35.8J
Potassium	--	--	1110J	495J	745J	274J	175J	6500J	2760J	490J
Selenium	63	3100	0.82J	1.6J	1.9J	1J	0.76U	2.7J	33.3	1.9
Silver	110	4100	0.52U	0.54U	0.52J	0.12U	0.11U	0.67U	0.88U	0.12U
Sodium	--	--	6950	864U	346U	363U	210U	5950	1390J	178U
Thallium	2	2	0.98U	1U	0.78UJ	0.7U	1.5J	<u>2.6J</u>	1.6U	0.72U
Vanadium	370	7100	50.5	31.6	210J	4.7J	3.1J	20.2	40	18.1J
Zinc	1500	1500	55.2	35.6	561J	3.5UJ	24.6J	703	22.7	302J

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: LOSB4	LOSB4	LOS88	LOS89	LOS89	LOS810	LOS810	LOS811	LOS812
	Residential	Non-Residential	Depth: 02	06	02	02	06	04	08	02	02
			Zone **: LO	LO	SS	LO	LO	LO	LO	LO	LO
			Date: 10/24/94	10/24/94	10/24/94	10/25/94	10/25/94	10/28/94	10/28/94	10/25/94	10/25/94
Aluminum	--	--	5490J	9140J	4400J	7800J	1470	2780	2210	3140J	4220J
Antimony	14	340	0.54UJ	0.43UJ	1.1UJ	0.66UJ	0.67UJ	1.3UJ	0.28UJ	0.48UJ	2.7UJ
Arsenic	20	20	18.8	7J	<u>34.9</u>	13.1J	<u>35.3J</u>	<u>36.9J</u>	15J	4J	<u>28.3J</u>
Barium	700	47000	263	164	69.9	49.7J	33.3J	75	32.3J	25.2J	142
Beryllium	1	1	0.17J	0.18J	0.25J	0.15J	0.05U	0.16J	0.13J	0.16J	0.23J
Cadmium	1	100	R	R	R	0.31J	0.11J	0.73J	0.56J	0.19J	5J
Calcium	--	--	3470J	7210J	9130J	6700J	932J	1630	1020J	2210J	3120J
Cobalt	--	--	7.7J	13.2	7.6J	12.1J	2.5J	3.9J	6.9J	5J	8.4J
Copper	600	600	62J	56.5J	221J	70.1J	26.3J	66.6J	38.9J	42.1J	177J
Cyanide	1100	21000	0.53U	0.53U	0.58U	0.64U	0.56U	3.8	0.58U	0.66U	0.71U
Iron	--	--	24100	22400	50100	24300	7370	17000	11500	10200	43500
Lead	400	600	277J	163J	347J	144J	217	579	89.7	63.2J	292J
Magnesium	--	--	3260J	6900J	2170J	5780J	886J	1140	410J	1180J	2020J
Manganese	--	--	305J	295	202J	274	31	116	45.9	74.3	213
Mercury	14	270	0.38	0.46	4.8	4.1	0.24J	2.8J	0.25J	0.46	9.8J
Nickel	250	2400	20.8J	22.8J	37.8J	19.9J	5.8J	14.2	11.9	11.6J	35J
Potassium	--	--	563J	398J	732J	429J	252J	502J	308J	304J	493J
Selenium	63	3100	0.71UJ	0.72UJ	1.2J	0.86U	0.74U	1.2	1.3	0.88U	1.2J
Silver	110	4100	0.13J	0.18J	0.17J	0.13U	0.11U	0.11U	0.12U	0.13U	0.22J
Sodium	--	--	328U	53.8U	527U	1480	354U	465U	458U	333U	530U
Thallium	2	2	0.63UJ	0.64UJ	0.7UJ	0.76U	0.65U	0.68U	0.69U	0.78U	0.85UJ
Vanadium	370	7100	31J	49.6J	74.7J	49.2J	13.4	24.5	9.4J	37.3J	73.2J
Zinc	1500	1500	116J	61	549J	121	41.9J	208J	201J	216	1100

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: LOSB12	LOSB13	LOSB13FR	LOSB13	LOSB14	LOSB15	LOSB16	LOSB17
	Residential	Non-Residential	Depth: 06	02	02	08	02	02	04	02
			Zone**: LO	LO	LO	LO	LO	LO	LO	LO
			Date: 10/25/94	10/31/94	10/31/94	10/31/94	10/25/94	10/24/94	10/25/94	10/24/94
Aluminum	--	--	1170	3550	3780	3290J	6280J	6430J	1940	3370J
Antimony	14	340	0.54UJ	3.4J	1.8UJ	1.6J	1.5UJ	4.4J	0.44UJ	0.55UJ
Arsenic	20	20	8.7J	<u>249J</u>	<u>51.3J</u>	<u>64.3J</u>	18J	<u>23.4</u>	<u>69.8J</u>	<u>27.3</u>
Barium	700	47000	26.5J	60	67.1	48.3	83.9	152	144	53.4
Beryllium	1	1	0.05U	0.21J	0.27J	0.2J	0.4J	0.55J	0.1U	0.2J
Cadmium	1	100	0.17J	0.9J	1.1J	R	R	R	3.7	1.2
Calcium	--	--	1580	5580J	3250J	6720J	5180J	4800J	1090J	19700J
Cobalt	--	--	4.1J	4.5J	4.9J	5.2J	5.6J	27.7	5.9J	5.3J
Copper	600	600	28.4J	112J	78.6J	52.3J	95.2J	190J	70.8J	72.2J
Cyanide	1100	21000	0.64U	0.57U	0.57U	0.56UJ	0.67U	0.58U	0.56U	0.6U
Iron	--	--	13200	18800	18700	24800	33700	35500	7690	18100
Lead	400	600	75.1	<u>792J</u>	458J	257J	<u>671J</u>	455J	449	<u>1010J</u>
Magnesium	--	--	1120J	1930	1160	3290J	1180J	2250J	708J	1070J
Manganese	--	--	43.7	129	202	280	418	196J	35.3	157J
Mercury	14	270	0.47J	1.7J	1.6J	1.3	0.7	1	0.29J	0.67
Nickel	250	2400	14.6	19.5	19.1	11.2J	22.5J	91.3J	21.4	41.7J
Potassium	--	--	251J	403J	472J	423J	791J	1060J	322J	526J
Selenium	63	3100	0.98J	2.1	1.9	2J	0.91UJ	1.8J	0.75U	1.5
Silver	110	4100	0.13U	0.18J	0.18J	0.13J	0.13UJ	0.33J	0.11U	0.12J
Sodium	--	--	267U	178U	461U	197U	748J	2050	327U	1650
Thallium	2	2	0.76U	0.69U	0.67U	0.67UJ	0.8UJ	0.7UJ	0.66U	0.72U
Vanadium	370	7100	23.9	34.6	35	16.8J	69J	64.1J	12.1	13.2J
Zinc	1500	1500	32.5J	174J	213J	137	76.9	221J	887J	290J

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: LOSB18-02	LOSB18	LOSB18FR	MBSB01	MBSB02	MBSB03	MBSB03	MBSB03FR
	Residential	Non-Residential	Depth: 02	08	08	02	02	06	10	10
			Zone **: LO	LO	LO	MB	MB	MB	MB	MB
			Date: 10/24/94	10/24/94	10/24/94	10/25/94	10/21/94	10/25/94	10/25/94	10/25/94
Aluminum	--	--	3660J	999J	1130J	5540J	2710J	21400J	2780J	2090J
Antimony	14	340	1.2UJ	0.38UJ	0.31UJ	1.2UJ	0.28UJ	R	4.5J	3UJ
Arsenic	20	20	<u>26.4</u>	<u>30.8</u>	<u>25.6</u>	17.2	9.4	10.7J	<u>225J</u>	<u>180J</u>
Barium	700	47000	55.7	19.9J	18J	63.1	33.5J	61.3	22.9J	14.6J
Beryllium	1	1	0.23J	0.09U	0.12U	0.22J	0.52J	0.84J	0.23J	0.19J
Cadmium	1	100	0.37J	0.08U	0.08U	R	0.1J	0.25J	0.09UJ	0.08UJ
Calcium	--	--	10600J	748J	693J	15100J	1640J	15500J	1150J	1250J
Cobalt	--	--	5.2J	2.7J	3.2J	29.9	8.9J	5.9J	14.9	6.8J
Copper	600	600	57.2J	16.8J	14.9J	182J	81.2J	97.5J	<u>24100J</u>	<u>17100J</u>
Cyanide	1100	21000	0.57U	0.67U	0.65U	0.57U	0.58U	0.74U	0.72U	0.69U
Iron	--	--	11600	3840	5570	27000	10200	20200	20300	17000
Lead	400	600	111J	4.9J	4.4J	219J	120J	47.3J	<u>675J</u>	505J
Magnesium	--	--	1230J	159J	160J	2270J	1240J	19800J	485J	376J
Manganese	--	--	133J	8.9J	9.7J	193J	62.9J	230	65.7	72.7
Mercury	14	270	0.38	0.13U	0.13U	0.51	0.37	0.18	0.22	0.16
Nickel	250	2400	26.9J	9.3J	10.3J	106J	32.3J	24.8J	125J	49J
Potassium	--	--	591J	286J	329J	993J	345J	3550	300J	247J
Selenium	63	3100	1.1J	0.9U	0.88U	0.77U	0.78U	1U	1.5	1.4J
Silver	110	4100	0.11U	0.13U	0.13U	0.11UJ	0.13J	0.15U	5.1J	3.6J
Sodium	--	--	525U	458U	526U	3400	622U	1670	325U	283U
Thallium	2	2	0.69UJ	0.79U	0.78U	0.68UJ	0.69U	0.89U	0.88U	0.83U
Vanadium	370	7100	21.4J	7J	6.7J	35.5J	72.9J	60.7J	18.2J	14.1J
Zinc	1500	1500	98.4J	10.8UJ	13.1J	107J	160J	53.6	298	169

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: MDCSB02	N2TFSB2	N2TFSB4	N2TFSB4	N2TFSB5	N2TFSB5	N3TFSB2
	Residential	Non-Residential	Depth: 03	02	02	06	02	06	02
			Zone**: MDC	N2TF	N2TF	N2TF	N2TF	N2TF	AP
			Date: 10/11/94	10/19/94	10/28/94	10/28/94	10/19/94	10/19/94	10/19/94
Aluminum	--	--	7030	7530	14600	2520	8270	5490J	3570
Antimony	14	340	0.82J	10.4J	19.2J	6.1J	10.7J	1.3UJ	0.96J
Arsenic	20	20	10	9.8	7.1J	8.1J	5.5J	5.8	18.3
Barium	700	47000	107	77.7	68.7	19J	45.9	20.4J	32.2J
Beryllium	1	1	0.18J	0.26J	0.36J	0.74J	0.33J	0.31J	0.17U
Cadmium	1	100	0.52J	R	R	0.8J	R	0.07U	R
Calcium	--	--	21200	27300J	44800	4760	15600J	1950J	141000J
Cobalt	--	--	6.9J	35	74.6	12.7	32.3	8.9J	4.1J
Copper	800	600	85.3	71.6	119J	43.9J	73.1	36.1J	71.2
Cyanide	1100	21000	.55U	0.74	0.66U	0.63U	0.57U	0.57U	0.57U
Iron	--	--	19800	36200	53200	12000	26400	14100	25500
Lead	400	600	528	342	357	95J	119	40.7J	159
Magnesium	--	--	4190	10900	22500	2530	7860	2080J	1620
Manganese	--	--	154J	227	402	77.2	201	90.7J	257
Mercury	14	270	0.88J	15.4	0.55J	0.21J	0.14	0.11U	1.4
Nickel	250	2400	51.6	154	301	43	118	28.5J	67.1
Potassium	--	--	851J	586J	607J	343J	723J	906J	1000J
Selenium	63	3100	0.61UJ	0.84UJ	0.89UJ	1.3	0.76UJ	0.76U	0.76UJ
Silver	110	4100	0.1J	0.59U	0.25J	0.79J	0.53U	0.11U	0.54U
Sodium	--	--	1510J	R	55.6U	186U	442UJ	220U	R
Thallium	2	2	0.66UJ	1.1UJ	1.2J	3.7	1UJ	0.67U	1UJ
Vanadium	370	7100	37.6	188	373	53.9	159	47.3J	34.4J
Zinc	1500	1500	111	134	308J	76.3J	178	54.7J	101

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: N3TFSB2	N3TFSB2FR	N3TFSB1	N3TFSB3	N3TFSB4	N3TFSB5	N3TFSB6
	Residential	Non-Residential	Depth: 06	06	02	02	02	08	02
			Zone **: AP	AP	N3TF	N3TF	N3TF	N3TF	N3TF
			Date: 10/19/94	10/19/94	10/18/94	10/13/94	10/17/94	10/19/94	10/18/94
Aluminum	--	--	4830	3480	10000	12400	13900	4110	7590
Antimony	14	340	1.1J	0.8J	1.1J	17.1J	26.5J	2.1J	12.1J
Arsenic	20	20	<u>120J</u>	<u>47.4J</u>	9.7	7.3	8.9	2J	<u>27.9</u>
Barium	700	47000	35.5J	21.4J	76.7	36.9J	49.6	7.6J	86.1
Beryllium	1	1	0.2U	0.14U	0.42J	0.14J	0.22J	0.3J	0.12U
Cadmium	1	100	0.38U	0.25U	R	R	R	0.11U	R
Calcium	--	--	3220J	2310J	2880J	29400J	57400J	229J	26800J
Cobalt	--	--	6.5J	7.7J	7	125	77.7	4.3J	34.2
Copper	600	600	70.5	51.5	48.6	48.6J	43.6J	13	107
Cyanide	1100	21000	0.68U	0.66U	0.57U	0.6U	0.6U	0.58U	0.6U
Iron	--	--	10900	10600	23300	65100	51200	10700	27500
Lead	400	600	<u>770J</u>	170J	110	70.9	83.9	5.1	131
Magnesium	--	--	5010J	2520J	2010	39400	29800	1250	9240
Manganese	--	--	71.8	74.7	194	492	480	82.9	219
Mercury	14	270	0.4	0.63	0.29	0.17	0.38	0.12U	0.16
Nickel	250	2400	64.5	62.7	46.8	485	331	30.7	172
Potassium	--	--	1000J	452J	868J	330J	610J	937J	532J
Selenium	63	3100	0.91UJ	1.5J	0.75UJ	0.8UJ	0.81UJ	0.79U	0.81UJ
Silver	110	4100	0.64U	0.61U	0.53U	0.56U	0.57U	0.56U	0.57U
Sodium	--	--	777U	202U	275UJ	50.1U	R	130U	R
Thallium	2	2	1.2UJ	1.1UJ	0.99UJ	1.1UJ	1.1UJ	1UJ	1.1UJ
Vanadium	370	7100	28.1	23.5	53.4	613	409	12.2	197
Zinc	1500	1500	103	64.7	226	240	168	57.2	136

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: N3TFSB7	N3TFSB8	N3TFSB8	N3TFSB9	PN1SB2	PN1SB2	PSSB1	PSSB1
	Residential	Non-Residential	Depth: 02	02	06	02	04	08	02	06
			Zone **: N3TF	N3TF	N3TF	N3TF	P1	P1	MB	MB
			Date: 10/18/94	10/18/94	10/18/94	11/02/94	11/02/94	11/02/94	10/31/94	10/31/94
Aluminum	--	--	10900	12700	10500J	5510	1860	5770	4140	1360
Antimony	14	340	17.4J	30.9J	0.29UJ	108J	0.26UJ	1.1UJ	0.27UJ	1.3UJ
Arsenic	20	20	<u>23.7</u>	<u>372</u>	4.9	<u>361J</u>	7.1J	<u>37.4J</u>	<u>25.2J</u>	<u>76.6J</u>
Barium	700	47000	57.5	53.5	25.4J	102	51.3	45.2J	29.8J	26.5J
Beryllium	1	1	0.19U	<u>1.5</u>	0.44J	0.1U	0.12J	0.38J	0.22J	0.08U
Cadmium	1	100	R	R	0.07U	R	0.51J	1.6	0.68J	0.28J
Calcium	--	--	37800J	31500J	355J	17100	5730	110000	15900	2070
Cobalt	--	--	53.9	88.3	4.3J	23.9	5.2J	7.5J	3.7J	3.3J
Copper	600	600	52.9	104	97.3J	99J	53.7J	143J	86.1J	118J
Cyanide	1100	21000	0.63U	0.59U	0.61U	0.63U	0.59	0.59U	0.58U	0.58U
Iron	--	--	41800	51900	19200	48900	8800	16300	9190	7200
Lead	400	600	180	261	7.9J	<u>2460</u>	98	262	105J	159
Magnesium	--	--	20700	28700	2240J	9280	759J	5660	1830	443J
Manganese	--	--	321	400	107J	212	52.6	660	116	34.6
Mercury	14	270	0.17	0.24	0.12U	7.9J	21.9J	2.3J	0.11UJ	0.21J
Nickel	250	2400	343	378	22.4J	143	15.1	14.6	15.8	20.7
Potassium	--	--	669J	869J	1370J	469J	417J	903J	575J	347J
Selenium	63	3100	0.82UJ	0.8UJ	0.82U	9.2J	1.3	0.8U	0.77U	2
Silver	110	4100	0.58U	0.57U	0.12U	0.7J	0.11U	0.41J	0.11U	0.11U
Sodium	--	--	652UJ	7120J	355U	225U	243U	233U	942U	333U
Thallium	2	2	1.1UJ	1.6J	0.72U	1.1J	0.66U	0.7U	0.68U	0.67U
Vanadium	370	7100	314	384	20.9J	269	13.7	23.4	30.6	11.4
Zinc	1500	1500	105	412	120J	131J	122J	261J	212J	131J

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: SSB1	SSB3	SSB3	STFSB1	STFSB1	STFSB2
	Residential	Non-Residential	Depth: 16	08	10	02	06	08
			Zone*: SS	SS	SS	STF	STF	STF
			Date: 10/24/94	10/24/94	10/24/94	10/26/94	10/26/94	10/26/94
Aluminum	--	--	3020J	1050J	6000J	8560J	4300	3220
Antimony	14	340	0.81UJ	5.6J	0.93U	2.6J	0.86UJ	0.3UJ
Arsenic	20	20	<u>104J</u>	<u>60.4J</u>	<u>42.8J</u>	8J	9.3J	2J
Barium	700	47000	39.2J	28.8J	61.5	138	46J	18.4J
Beryllium	1	1	0.18J	0.09J	0.63J	0.57J	0.22J	0.16J
Cadmium	1	100	0.07UJ	0.1UJ	0.46J	0.34J	0.08J	0.08UJ
Calcium	--	--	16700J	3370J	53700J	18500J	3970	510U
Cobalt	--	--	4J	4.2J	10.6J	36.6	37.1	19.2
Copper	600	600	44.6J	84.1J	165	129J	133J	103J
Cyanide	1100	21000	0.59U	0.82U	30.7	0.58U	0.67U	0.64U
Iron	--	--	10500	14300	16600	17500	12100	9080
Lead	400	600	331J	178J	155J	116J	71.3	20.8
Magnesium	--	--	1830J	525J	6290J	6880J	1820	1010J
Manganese	--	--	248	30.3	194	189	83.2	51.3
Mercury	14	270	1.3	2.6	1.9	0.24	0.16J	0.12UJ
Nickel	250	2400	10.5J	6.5J	16.7J	118J	90.6	93.9
Potassium	--	--	697J	461J	1370	890J	892J	807J
Selenium	83	3100	0.89J	4.8	2.2	0.79U	1.3J	0.86U
Silver	110	4100	0.12U	0.54J	0.19J	0.12U	0.13U	0.13U
Sodium	--	--	599J	299U	465U	780U	1050U	3010
Thallium	2	2	0.7U	0.98U	0.79U	0.7U	0.78U	0.76U
Vanadium	370	7100	12.5J	14.1J	15.9J	81.3J	42.4	21.2
Zinc	1500	1500	76.9	36.1	208	165	38J	40.9J

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: FBNA1-100594	FBNA5-101994	FBNA6-102094	FBNA7-102594	FBNA9-102694
	Residential	Non-Residential	Depth:				
			Zone**:				
			Date: 10/05/94	10/19/94	10/20/94	10/25/94	10/26/94
Aluminum	--	--	62.2J	82.5J	82.4J	88.5J	334
Antimony	14	340	1.2U	1.2U	1.2U	2.8J	1.2U
Arsenic	20	20	5U	2.4U	2.4U	2.4U	2.4U
Barium	700	47000	1.7J	0.3J	0.97J	1.2J	3.1J
Beryllium	1	1	0.1U	0.1U	0.1U	0.1U	0.1U
Cadmium	1	100	0.3U	0.3U	0.3U	0.3U	0.3U
Calcium	--	--	19.9J	2.8U	2.8U	29.9J	488J
Cobalt	--	--	0.5U	0.5U	0.5U	0.5U	0.5U
Copper	600	600	0.3U	0.3U	0.3U	0.35J	5.9J
Cyanide	1100	21000	10U	10U	10U	10U	10U
Iron	--	--	7U	15.8J	19.6J	43.7J	2000
Lead	400	600	1.4U	1.4U	1.4U	1.4U	4.4
Magnesium	--	--	6.7J	3.6U	3.6U	9J	81.1J
Manganese	--	--	0.2U	0.2U	1.4J	0.35J	20.6
Mercury	14	270	0.2U	0.2U	0.2U	0.2U	0.2U
Nickel	250	2400	0.7U	0.7U	6.7J	0.7U	2.8J
Potassium	--	--	61.1J	51.3J	41.7J	52.4J	186J
Selenium	83	3100	3.4U	3.4U	3.4U	3.4U	3.4U
Silver	110	4100	2.4U	0.5U	0.5U	0.5U	0.5U
Sodium	--	--	373J	213U	215J	297J	914J
Thallium	2	2	4.5U	3U	3U	3U	3U
Vanadium	370	7100	0.53J	0.4U	0.4U	0.4U	0.71J
Zinc	1500	1500	2.3J	1.1J	2J	8.8J	7.3J

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/kg)	NJDEP Soil Cleanup Criteria *		Sample ID: FBNA11-102794	FBNA13-102894	FBNA14-102894	FBNA17-103194
	Residential	Non-Residential	Depth:			
			Zone**:			
			Date: 10/27/94	10/28/94	10/28/94	10/31/94
Aluminum	--	--	168J	151J	114J	166J
Antimony	14	340	1.2U	1.2U	1.2U	1.2U
Arsenic	20	20	2.4U	2.4U	2.4U	2.4U
Barium	700	47000	1.1J	0.85J	0.85J	0.27J
Beryllium	1	1	0.1U	0.1U	0.1U	0.1U
Cadmium	1	100	0.3U	0.3U	0.3U	0.3U
Calcium	--	--	63.2J	65.2J	35.7J	21.1J
Cobalt	--	--	0.5U	0.5U	0.5U	0.5U
Copper	600	600	0.3U	0.3U	0.3U	1.6J
Cyanide	1100	21000	10U	10U	10U	10U
Iron	--	--	66.3J	31.4J	41.9J	7U
Lead	400	600	1.4U	1.4U	1.4U	1.4U
Magnesium	--	--	15.6J	21.9J	17.1J	11.8J
Manganese	--	--	2.1J	0.45J	0.57J	0.25J
Mercury	14	270	0.2U	0.2U	0.2U	0.2U
Nickel	250	2400	0.7U	0.7U	0.7U	1.7J
Potassium	--	--	128J	136J	114J	151J
Selenium	63	3100	3.4U	3.4U	3.4U	3.4U
Silver	110	4100	0.5U	0.5U	0.5U	0.5U
Sodium	--	--	672J	771J	699J	769J
Thallium	2	2	3U	3U	3U	3U
Vanadium	370	7100	0.4U	0.4U	0.4U	0.4U
Zinc	1500	1500	1.5J	8.1J	6.9J	0.74J

See last page for footnotes.



Table 5-5. Metals and Cyanide in Soil Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in milligrams per kilogram (mg/kg) (equivalent to parts per million [ppm]).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols contained in the Statement of Work (SOW) ILM03.

Sample results exceeding the NJDEP non-residential criteria are underlined.

Chromium results are reported separately in Table 5-6.

FBNA Indicates a field blank associated with non-aqueous samples.

PQL Practical quantitation level.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specific detection limit.

J Estimated result.

R Rejected result.

-- No applicable criteria.

* NJDEP soil cleanup criteria, February 3, 1992; last revised February 3, 1994.

** Zones as defined in Table 3-2.



Table 5-6. Total and Hexavalent Chromium in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample Location	Zone*	Sample Date	Sample Depth (ft bls)	Total Chromium Comparative Criteria of 10,000 mg/kg	Hexavalent Chromium Comparative Criteria of	
					100 mg/kg	10 mg/kg
3TFIRMB3	N3TF	10/6/94	04	225J	NA	NA
3TFIRMB3	N3TF	10/6/94	14	17.9J	NA	NA
3TFIRMB4	N3TF	10/17/94	02	3100	9.2J	9.2J
3TFIRMB4	N3TF	10/17/94	06	678	NA	NA
AGTFSB1	AGTF	10/20/94	02	418	2.57UJ	2.57UJ
AGTFSB1	AGTF	10/20/94	06	16.2	R	R
AGTFSB2	AGTF	10/28/94	04	129	2.29UJ	2.29UJ
AGTFSB3	AGTF	10/27/94	02	1670	79.81J	<u>79.81J</u>
AGTFSB3	AGTF	10/27/94	06	1300	2.49UJ	2.49UJ
AGTFSB4	AGTF	10/20/94	02	284	7.04J	7.04J
AGTFSB4	AGTF	10/20/94	06	154	R	R
AHTFSB1	AHTF	10/19/94	02	10.9	R	R
AHTFSB1	AHTF	10/19/94	04	10.9J	2.31UJ	2.31UJ
AHTFSB2	AHTF	10/14/94	02	30.4	15J	<u>15J</u>
AHTFSB2	AHTF	10/14/94	06	26.6J	NA	NA
AHTFSB3	AHTF	10/20/94	06	9.3	R	R
AHTFSB3	AHTF	10/20/94	10	9	R	R
AHTFSB4	AHTF	10/14/94	02	10.8	7.5J	7.5J
AHTFSB4	AHTF	10/14/94	08	47	NA	NA
APSB1	AP	10/27/94	06	10.9	2.4UJ	2.4UJ
APSB1	AP	10/27/94	10	3.9	2.4UJ	2.4UJ
APSB2	AP	10/26/94	02	177	5.7J	5.7J
APSB2	AP	10/26/94	06	219	9.66J	9.66J
APSB3	AP	10/21/94	06	18J	2.44UJ	2.44UJ
APSB4	AP	10/21/94	04	18.2J	2.57UJ	2.57UJ
APSB4	AP	10/21/94	08	7J	2.41UJ	2.41UJ
APSB5	AP	10/12/94	02	685J	5.6J	5.6J
APSB5	AP	10/12/94	06	107	NA	NA
APSB6	AP	10/21/94	06	37.1	7.05J	7.05J
APSB6	AP	10/21/94	10	5.3	2.61UJ	2.61UJ
DTSB1	DT	10/27/94	06	38.1	2.18UJ	2.18UJ
DTSB1	DT	10/27/94	08	22.2	2.27UJ	2.27UJ
DTSB2	DT	10/27/94	04	8.8	2.26UJ	2.26UJ
DTSB2	DT	10/27/94	08	8.9	2.28UJ	2.28UJ
DTSB3	DT	10/27/94	04	56.1	2.44UJ	2.44UJ
DTSB3FR1	DT	10/27/94	4	41.6	2.46UJ	2.46UJ
DTSB3FR2	DT	10/28/94	4	NA	2.37UJ	2.37UJ
EC2SB1	ECP	10/27/94	04	13.9	2.31UJ	2.31UJ

See last page for footnotes.



Table 5-6. Total and Hexavalent Chromium in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample Location	Zone*	Sample Date	Sample Depth (ft bls)	Total Chromium Comparative Criteria of 10,000 mg/kg	Hexavalent Chromium Comparative Criteria of	
					100 mg/kg	10 mg/kg
EC2SB1	ECP	10/27/94	12	15.6	2.21UJ	2.21UJ
ECIRMB1	U	10/24/94	02	3.7	2.34UJ	2.34UJ
ECIRMB1	U	10/24/94	06	8.9J	3.38UJ	3.38UJ
ECIRMB3	N3TF	10/19/94	02	358	R	R
ECIRMB3	N3TF	10/19/94	06	10	2.63UJ	2.63UJ
ECPSB1	ECP	10/20/94	02	8.2	11.94J	<u>11.94J</u>
ECPSB1	ECP	10/20/94	08	3.8	R	R
ECPSB2	ECP	10/20/94	06	6.2	R	R
ECPSB2	ECP	10/20/94	12	24.9	R	R
ECPSB3	ECP	10/21/94	04	26.1	2.39UJ	2.39UJ
ECPSB4	ECP	10/19/94	08	13.3	R	R
ECPSB5	ECP	10/19/94	02	130	R	R
ECPSB5	ECP	10/19/94	08	8	2.28UJ	2.28UJ
EGTFSB1	GTF	10/27/94	04	6.1	2.53UJ	2.53UJ
GFSB1	STF	10/12/94	02	65.9J	NA	NA
GFSB1	STF	10/12/94	06	13.9	NA	NA
GTFIRMB1	GTF	11/16/94	02	255J	2.37UJ	2.37UJ
GTFIRMB1	GTF	10/6/94	08	36.3	NA	NA
GTFIRMB2	GTF	10/17/94	02	326	3.3J	3.3J
GTFIRMB2	GTF	10/17/94	08	7.9	NA	NA
GTFIRMB3	GTF	11/16/94	02	190J	2.28UJ	2.28UJ
GTFIRMB3	GTF	10/5/94	10	13.5J	NA	NA
GTFIRMB4	GTF	10/17/94	02	1680	48.1J	<u>48.1J</u>
GTFIRMB4	GTF	10/17/94	08	27.2	NA	NA
GTFIRMB5	GTF	10/5/94	02	65.9J	7J	7J
GTFIRMB5FR	GTF	10/5/94	2	40.6J	R	R
GTFIRMB5	GTF	10/5/94	06	22.3J	NA	NA
GTFIRMB6	GTF	10/5/94	04	19.5J	NA	NA
GTFIRMB6	GTF	10/5/94	08	75.1J	NA	NA
GTFIRMB7	GTF	10/17/94	02	63.3	12.8J	<u>12.8J</u>
GTFIRMB7	GTF	10/17/94	08	40.9	NA	NA
GTFIRMB8	GTF	10/18/94	02	104	2.32UJ	2.32UJ
GTFIRMB8	GTF	10/18/94	08	85.4	2.55UJ	2.55UJ
GTFIRMB9	GTF	10/5/94	02	173J	2.62UJ	2.62UJ
GTFIRMB9	GTF	10/5/94	06	44.5J	NA	NA
GTFSB1	GTF	10/10/94	02	42.9J	19.8J	<u>19.8J</u>
GTFSB1	GTF	10/10/94	08	15.4J	NA	NA
GTFSB2	GTF	10/13/94	02	41.2	16J	<u>16J</u>

See last page for footnotes.



Table 5-6. Total and Hexavalent Chromium in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample Location	Zone*	Sample Date	Sample Depth (ft bls)	Total Chromium Comparative Criteria of 10,000 mg/kg	Hexavalent Chromium Comparative Criteria of	
					100 mg/kg	10 mg/kg
GTFSB2	GTF	10/13/94	08	19.2	NA	NA
GTFSB3	GTF	10/10/94	02	21.9J	1J	1J
GTFSB3	GTF	10/10/94	08	250	NA	NA
GTFSB4	GTF	10/13/94	02	132J	1.2J	1.2J
GTFSB4	GTF	10/13/94	08	34.3	NA	NA
GTFSB4FR	GTF	10/13/94	8	57.1	NA	NA
GTFSB5	GTF	10/13/94	02	59.3J	2.2UJ	2.2UJ
GTFSB5	GTF	10/13/94	08	29.8J	NA	NA
GTFSB6	GTF	10/11/94	02	24.9J	1.7J	1.7J
GTFSB6	GTF	10/11/94	12	20.1	NA	NA
GTFSB7	GTF	10/13/94	02	68.3	2.63UJ	2.63UJ
GTFSB7	GTF	10/13/94	08	16	NA	NA
GTFSB8	GTF	10/13/94	04	35.1	NA	NA
GTFSB8	GTF	10/13/94	08	20.8	NA	NA
GTFSB9	GTF	10/13/94	02	342	7.2J	7.2J
GTFSB9	GTF	10/13/94	08	573	2.28UJ	2.28UJ
LAIRMB1	LO	10/24/94	02	38.9	4.17J	4.17J
LAIRMB1	LO	10/24/94	08	17.7J	3UJ	3UJ
LOSB1	LO	10/25/94	04	2.3J	2.32UJ	2.32UJ
LOSB1	LO	10/25/94	08	1.4J	2.29UJ	2.29UJ
LOSB2	LO	11/16/94	04	21.6	NA	NA
LOSB2	LO	10/14/94	08	30.9	NA	NA
LOSB3	LO	10/24/94	02	8.5	2.48UJ	2.48UJ
LOSB3	LO	10/24/94	04	13J	2.64UJ	2.64UJ
LOSB4	LO	10/24/94	02	19.2	2.14UJ	2.14UJ
LOSB4	LO	10/24/94	06	30.2	2.16UJ	2.16UJ
LOSB5	LO	10/11/94	04	6J	NA	NA
LOSB5	LO	10/11/94	08	6.4J	NA	NA
LOSB6	LO	10/25/94	04	8.3J	2.69UJ	2.69UJ
LOSB7	LO	10/14/94	04	5.5J	NA	NA
LOSB8	SS	10/24/94	02	22.4	2.31UJ	2.31UJ
LOSB8	SS	10/24/94	08	11.4J	2.69UJ	2.69UJ
LOSB9	LO	10/25/94	02	19.2	2.5UJ	2.5UJ
LOSB9	LO	10/25/94	06	4.4U	2.22UJ	2.22UJ
LOSB10	LO	10/28/94	04	26.5	2.26UJ	2.26UJ
LOSB10	LO	10/28/94	08	5.7U	2.36UJ	2.36UJ
LOSB11	LO	10/25/94	02	44.7	2.62UJ	2.62UJ
LOSB11	LO	10/25/94	06	12.6	2.65UJ	2.65UJ

See last page for footnotes.



Table 5-6. Total and Hexavalent Chromium in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample Location	Zone*	Sample Date	Sample Depth (ft bls)	Total Chromium Comparative Criteria of 10,000 mg/kg	Hexavalent Chromium Comparative Criteria of	
					100 mg/kg	10 mg/kg
LOSB12	LO	10/25/94	02	53.6	2.79UJ	2.79UJ
LOSB12	LO	10/25/94	06	32.3	2.58UJ	2.58UJ
LOSB13	LO	10/31/94	02	86.5	2.26UJ	2.26UJ
LOSB13-FR	LO	10/31/94	2	73	2.32UJ	2.32UJ
LOSB13	LO	10/31/94	08	14.7	2.26UJ	2.26UJ
LOSB14	LO	10/25/94	02	68.7	2.71UJ	2.71UJ
LOSB14	LO	10/25/94	06	40.5	2.21UJ	2.21UJ
LOSB15	LO	10/24/94	02	96.2	2.35UJ	2.35UJ
LOSB16	LO	10/25/94	04	53.8	2.19UJ	2.19UJ
LOSB16	LO	10/25/94	08	138	2.33UJ	2.33UJ
LOSB17	LO	10/24/94	02	9.5	2.42UJ	2.42UJ
LOSB18	LO	10/24/94	02	8.9	2.3UJ	2.3UJ
LOSB18	LO	10/24/94	08	2.7	2.69UJ	2.69UJ
LOSB18FR	LO	10/24/94	08	3.1	2.59UJ	2.59UJ
MBSB1	MB	10/25/94	02	94.5	2.31UJ	2.31UJ
MBSB1	MB	10/25/94	08	20.1J	2.31UJ	2.31UJ
MBSB2	MB	10/21/94	02	53.4	2.34UJ	2.34UJ
MBSB2	MB	10/21/94	06	7.9J	2.35UJ	2.35UJ
MBSB3	MB	10/25/94	06	54.7	2.96UJ	2.96UJ
MBSB3	MB	10/25/94	10	5.4	2.38UJ	2.38UJ
MBSB3FR	MB	10/25/94	10	4.2	2.78UJ	2.78UJ
MBSB4	MB	10/21/94	04	1050J	13J	<u>13J</u>
MBSB4	MB	10/21/94	10	1830	23.96J	<u>23.96J</u>
MDCSB1	MDC	10/26/94	04	8.2	2.33UJ	2.33UJ
MDCSB1	MDC	10/26/94	08	11.4	2.36UJ	2.36UJ
MDCSB2	MDC	10/11/94	03	37.5J	NA	NA
N2TFSB1	N2TF	11/17/94	02	NA	11.8J	<u>11.8J</u>
N2TFSB1	N2TF	10/12/94	04	1580	NA	NA
N2TFSB1	N2TF	10/12/94	08	624	NA	NA
N2TFSB2	N2TF	10/19/94	02	1820	R	R
N2TFSB2	N2TF	10/19/94	06	24.8J	2.42UJ	2.42UJ
N2TFSB3	N2TF	10/19/94	06	5150	<u>255J</u>	<u>255J</u>
N2TFSB3	N2TF	10/19/94	10	610	8.46J	8.46J
N2TFSB4	N2TF	10/28/94	02	3890	2.61UJ	2.61UJ
N2TFSB4	N2TF	10/28/94	06	443	2.48UJ	2.48UJ
N2TFSB5	N2TF	10/19/94	02	1840	R	R
N2TFSB5	N2TF	10/19/94	06	266	2.31UJ	2.31UJ
N2TFSB6	N2TF	10/19/94	04	2420	73.8J	<u>73.8J</u>

See last page for footnotes.



Table 5-6. Total and Hexavalent Chromium in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample Location	Zone*	Sample Date	Sample Depth (ft bls)	Total Chromium Comparative Criteria of 10,000 mg/kg	Hexavalent Chromium Comparative Criteria of	
					100 mg/kg	10 mg/kg
N2TFSB6	N2TF	10/19/94	06	721	R	R
N3TFSB1	N3TF	10/18/94	02	180	2.27UJ	2.27UJ
N3TFSB1	N3TF	10/18/94	12	32.4J	2.25UJ	2.25UJ
N3TFSB2	AP	10/19/94	02	51.7	R	R
N3TFSB2	AP	10/19/94	06	31.9	R	R
N3TFSB2FR	AP	10/19/94	6	28.7	R	R
N3TFSB3	N3TF	10/13/94	02	3040	<u>175J</u>	<u>175J</u>
N3TFSB3	N3TF	10/13/94	08	3980J	NA	NA
N3TFSB4	N3TF	10/17/94	02	4570	2.12UJ	2.12UJ
N3TFSB4	N3TF	10/17/94	06	386J	NA	NA
N3TFSB5	N3TF	10/19/94	04	552	14.3J	<u>14.3J</u>
N3TFSB5	N3TF	10/19/94	08	386	14.1J	<u>14.1J</u>
N3TFSB6	N3TF	10/18/94	02	2060	2.42UJ	2.42UJ
N3TFSB6	N3TF	10/18/94	06	211J	2.69UJ	2.69UJ
N3TFSB7	N3TF	10/18/94	02	2980	2.49UJ	2.49UJ
N3TFSB7	N3TF	10/18/94	06	63.8	2.37UJ	2.37UJ
N3TFSB8	N3TF	10/18/94	02	4490	<u>293J</u>	<u>293J</u>
N3TFSB8	N3TF	10/18/94	06	24.8	2.46UJ	2.46UJ
N3TFSB9	N3TF	11/2/94	02	2760	2.58UJ	2.58UJ
PESTSB1	PEST	10/20/94	04	23.9	14.81J	<u>14.81J</u>
PESTSB2	PEST	10/20/94	10	28.6	3.64UJ	3.64UJ
PN1SB2	P1	11/2/94	04	7.4U	2.23UJ	2.23UJ
PN1SB2	P1	11/2/94	08	13.6	2.33UJ	2.33UJ
PSSB1	MB	10/31/94	02	9.2U	2.31UJ	2.31UJ
PSSB1	MB	10/31/94	06	5.6U	2.31UJ	2.31UJ
SSB1	SS	10/24/94	06	241J	2.25UJ	2.25UJ
SSB1	SS	10/24/94	16	16.6	2.31UJ	2.31UJ
SSB2	SS	10/12/94	04	29.1	NA	NA
SSB2	SS	10/12/94	08	8.7J	NA	NA
SSB3	SS	10/24/94	06	458	3.28UJ	3.28UJ
SSB3	SS	10/24/94	10	65.1	2.63UJ	2.63UJ
STFSB1	STF	10/26/94	02	424	2.37UJ	2.37UJ
STFSB1	STF	10/26/94	06	215	2.69UJ	2.69UJ
STFSB2	STF	10/26/94	04	45	2.19UJ	2.19UJ
STFSB2	STF	10/26/94	08	9.5U	2.61UJ	2.61UJ
STFSB3	STF	10/26/94	04	19.8	2.56UJ	2.56UJ
T998SB1	U	10/12/94	04	6J	NA	NA
T998SB1	U	10/12/94	08	12.7J	NA	NA

See last page for footnotes.

Table 5-6. Total and Hexavalent Chromium in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Sample Location	Zone*	Sample Date	Sample Depth (ft bls)	Total Chromium Comparative Criteria of 10,000 mg/kg	Hexavalent Chromium Comparative Criteria of	
					100 mg/kg	10 mg/kg
FBNA1-100594		10/5/94	--	0.7U	NA	NA
FBNA2-100694		10/6/94	--	0.7U	NA	NA
FBNA3-101194		10/11/94	--	0.7U	NA	NA
FBNA4-101394		10/13/94	--	0.76J	NA	NA
FBNA5-101994		10/19/94	--	0.7U	2U	2U
FBNA6-102094		10/20/94	--	0.83J	2U	2U
FBNA7-102194		10/21/94	--	5.4U	2U	2U
FBNA7-102594		10/25/94	--	0.7U	2U	2U
FBNA9-102694		10/26/94	--	9.6J	2U	2U
FBNA10-102694		10/26/94	--	NA	2U	2U
FBNA11-102794		10/27/94	--	0.7U	2U	2U
FBNA13-102894		10/28/94	--	0.7U	2U	2U
FBNA14-102894		10/28/94	--	0.7U	2U	2U
FBNA17-103194		10/31/94	--	0.7U	2U	2U
FBNA18-111694		11/16/94	--	NA	2U	2U

Analyte concentrations and comparative criteria in milligrams per kilogram (mg/kg) (equivalent to parts per million [ppm]).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols contained in the Statement of Work (SOW) ILM03.0 for total chromium and New Jersey Modified USEPA 3060A/7196 for hexavalent chromium

Some samples were analyzed for total chromium only and not for the remaining metals that constitute the target analyte list for metals. In these cases, the total chromium was analyzed using SW846 Method 6010.

Exceedances of comparative criteria are shown in bold and are underlined.

FBNA Indicates a field blank associated with a non-aqueous samples.
 FR Field replicate of previous sample.
 U The compound was analyzed for, but not detected at the specified detection limit.
 J Estimated result
 R Rejected result
 -- Not applicable
 NA Not analyzed
 ft bls Feet below land surface
 * Zones as defined in Table 3-2.

Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Totals for All Areas (breakdowns for individual areas follow)										
Volatile Organic Compounds (ug/kg)										
1,1,1-Trichloroethane	2800.00	2800.00	2800.00	1	108	1	0	0	0	0
1-Butanol	1700.00	363900.00	780000.00	3	108	3	0	0	0	0
2-Butanone	2.00	22.13	82.00	24	108	22	0	0	0	0
2-Hexanone	31.00	31.00	31.00	1	108	1	0	0	0	0
2-Propanol	17.00	17.00	17.00	1	108	1	0	0	0	0
4-Methyl-2-pentanone	7.00	50.75	160.00	4	108	4	0	0	0	0
Acetone	180.00	6110.00	18000.00	3	108	3	0	0	0	0
Benzene	1.00	892.68	11000.00	18	108	18	0	2	0	2
Carbon disulfide	2.00	4.75	11.00	4	108	4	0	0	0	0
Chlorobenzene	1.00	52818.24	880000.00	21	108	18	1	5	1	5
Chloroform	43.00	43.00	43.00	1	108	1	0	0	0	0
Ethylbenzene	1.00	2222.58	36000.00	33	108	31	0	0	0	0
Hexane	1.00	4680.41	120000.00	61	108	58	0	0	0	0
Methyl-t-butyl ether	10.00	10.00	10.00	1	108	1	0	0	0	0
Tetrachloroethane	1.00	2.00	3.00	2	108	2	0	0	0	0
Toluene	1.00	733.27	11000.00	30	108	28	0	0	0	0
Xylenes (Total)	1.00	3721.22	49000.00	48	108	43	0	4	0	4
n-Propylbenzene	1.00	6958.20	130000.00	54	108	50	0	0	0	0
Semivolatile Organic Compounds (ug/kg)										
1,2-Dichlorobenzene	62.00	940638.40	4700000.00	5	108	5	0	1	0	1
1,3-Dichlorobenzene	140.00	870.00	1200.00	2	107	2	0	0	0	0
1,4-Dichlorobenzene	80.00	31356.87	240000.00	9	108	8	0	1	0	1
2,4-Dimethylphenol	250.00	250.00	250.00	1	108	1	0	0	0	0
2-Chloronaphthalene	1900.00	1900.00	1900.00	1	108	1	0	0	0	0
2-Methylnaphthalene	46.00	24186.88	310000.00	70	108	66	0	0	0	0
4-Methylphenol	210.00	210.00	210.00	1	108	1	0	0	0	0
4-Nitrophenol	1800.00	1800.00	1800.00	1	108	1	0	0	0	0
Acenaphthene	40.00	2823.87	11000.00	15	108	14	0	0	0	0
Acenaphthylene	180.00	586.87	1100.00	3	108	3	0	0	0	0
Anthracene	44.00	4114.78	50000.00	27	108	25	0	0	0	0
Benzo(a)anthracene	100.00	4437.58	84000.00	62	108	57	11	0	10	0
Benzo(a)pyrene	45.00	4158.40	37000.00	53	108	49	36	0	33	0
Benzo(b)fluoranthene	88.00	4590.14	95000.00	59	108	55	9	1	8	1
Benzo(g,h,i)perylene	210.00	3126.43	14000.00	28	108	26	0	0	0	0
Benzo(k)fluoranthene	92.00	4564.58	95000.00	59	108	55	8	0	8	0
Butyl benzyl phthalate	220.00	220.00	220.00	1	108	1	0	0	0	0
Carbazole	51.00	3844.43	18000.00	7	108	7	0	0	0	0
Chrysene	170.00	5907.98	97000.00	78	108	73	2	0	2	0
Di-n-butyl phthalate	82.00	180.40	410.00	5	108	5	0	0	0	0
Di-n-octyl phthalate	47.00	47.00	47.00	1	108	1	0	0	0	0
Dibenz(a,h)anthracene	53.00	2471.92	21000.00	24	108	22	15	0	14	0
Dibenzofuran	47.00	2217.83	4300.00	8	108	8	0	0	0	0
Fluoranthene	82.00	1815.14	9300.00	51	108	47	0	0	0	0
Fluorene	71.00	3448.44	17000.00	25	108	23	0	0	0	0
Indeno(1,2,3-cd)pyrene	53.00	1928.08	14000.00	32	108	30	4	0	4	0
N-Nitrosodiphenylamine(1)	380.00	75180.00	150000.00	2	108	2	0	1	0	1
Naphthalene	45.00	18532.77	240000.00	35	108	32	0	2	0	2
Pentachlorophenol	75.00	5088.75	9600.00	4	108	4	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Totals for All Areas (continued)										
<u>Semivolatile Organic Compounds (ug/kg) (continued)</u>										
Phenanthrene	88.00	8043.04	84000.00	81	108	75	0	0	0	0
Pyrene	54.00	5706.83	120000.00	86	108	80	0	1	0	1
bis(2-Ethylhexyl)phthalate	110.00	1335.17	9300.00	28	108	27	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	4.10	2720.58	85000.00	32	105	30	1	1	1	1
4,4'-DDE	4.30	31.02	280.00	33	105	31	0	0	0	0
4,4'-DDT	4.60	1779.53	48000.00	27	105	26	1	0	1	0
Aldrin	2.10	25.50	110.00	9	105	9	0	0	0	0
Aroclor-1254	45.00	45.00	45.00	1	105	1	0	0	0	0
Aroclor-1260	77.00	77.00	77.00	1	105	1	0	0	0	0
Dieldrin	2.20	291.82	5600.00	20	105	19	1	0	1	0
Endosulfan I	3.40	15.45	35.00	4	105	4	0	0	0	0
Endosulfan II	20.00	20.00	20.00	1	105	1	0	0	0	0
Endosulfan sulfate	24.00	24.00	24.00	2	105	2	0	0	0	0
Endrin	3.70	12.00	25.00	5	105	5	0	0	0	0
Endrin aldehyde	0.79	18.84	88.00	11	105	10	0	0	0	0
Endrin ketone	1.70	18.11	74.00	15	105	14	0	0	0	0
Heptachlor epoxide	5.30	13.18	24.00	5	105	5	0	0	0	0
Methoxychlor	55.00	253.00	1500.00	13	105	12	0	0	0	0
alpha-BHC	5.80	5.80	5.80	1	105	1	0	0	0	0
alpha-Chlordane	1.50	13.07	38.00	18	105	17	0	0	0	0
beta-BHC	4.20	22.10	57.00	3	105	3	0	0	0	0
gamma-Chlordane	2.00	94.30	1800.00	23	105	22	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	808.00	5484.64	23300.00	111	112	88	0	0	0	0
Antimony	0.27	11.75	239.00	89	112	82	0	0	0	0
Arsenic	1.80	38.38	372.00	112	112	100	49	0	44	0
Barium	8.00	164.14	5290.00	112	112	100	0	0	0	0
Beryllium	0.07	0.38	2.00	92	112	82	4	0	4	0
Cadmium	0.08	1.86	18.40	48	112	43	0	0	0	0
Calcium	229.00	10781.71	141000.00	110	112	98	0	0	0	0
Chromium	1.40	378.19	5150.00	175	181	97	0	0	0	0
Cobalt	1.20	28.32	842.00	112	112	100	0	0	0	0
Copper	13.00	414.02	24100.00	112	112	100	8	0	6	0
Cyanide	0.59	3.07	30.70	18	112	14	0	0	0	0
Hexavalent chromium	1.00	39.813	293.00	32	141	23	17	17	12	12
Iron	2840.00	22971.73	104000.00	110	112	98	0	0	0	0
Lead	4.90	537.87	7590.00	112	112	100	22	0	20	0
Magnesium	53.90	4148.87	38400.00	112	112	100	0	0	0	0
Manganese	8.90	178.70	860.00	110	112	98	0	0	0	0
Mercury	0.10	1.84	21.90	98	112	88	0	0	0	0
Nickel	2.40	125.35	2850.00	112	112	100	1	0	1	0
Potassium	175.00	910.58	6500.00	109	112	97	0	0	0	0
Selenium	0.74	2.88	33.30	63	112	56	0	0	0	0
Silver	0.10	0.79	5.10	60	112	45	0	0	0	0
Sodium	599.00	5040.87	36300.00	30	112	27	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Totals for All Areas (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Thallium	1.10	2.23	3.70	8	112	7	4	0	4	0
Vanadium	3.10	77.78	813.00	112	112	100	0	0	0	0
Zinc	17.90	352.01	8080.00	110	112	98	3	0	3	0
"A"-Hill Tank Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
2-Butanone	8.00		8.00	1	4	25	0	0	0	0
Ethylbenzene	4.00		980.00	2	4	50	0	0	0	0
Hexene	17000.00		17000.00	1	4	25	0	0	0	0
Xylenes (Total)	1.00		810.00	2	4	50	0	0	0	0
n-Propylbenzene	82.00		12000.00	4	4	100	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
2-Methylnaphthalene	780.00		25000.00	4	4	100	0	0	0	0
Acenaphthene	1300.00		1300.00	1	4	25	0	0	0	0
Benzo(a)anthracene	410.00		410.00	1	4	25	0	0	0	0
Chrysene	400.00		1200.00	3	4	75	0	0	0	0
Dibenzofuran	980.00		980.00	1	4	25	0	0	0	0
Fluorene	1000.00		1800.00	2	4	50	0	0	0	0
Naphthalene	470.00		550.00	2	4	50	0	0	0	0
Phenanthrene	2800.00		4400.00	3	4	75	0	0	0	0
Pyrene	420.00		1500.00	3	4	75	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	5.80		21.00	2	4	50	0	0	0	0
4,4'-DDT	4.80		4.80	1	4	25	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	3730.00		8710.00	4	4	100	0	0	0	0
Antimony	0.41		2.70	3	4	75	0	0	0	0
Arsenic	9.00		88.80	4	4	100	2	0	50	0
Barium	32.80		85.80	4	4	100	0	0	0	0
Beryllium	0.21		0.42	4	4	100	0	0	0	0
Cadmium	0.12		0.12	1	4	25	0	0	0	0
Calcium	489.00		1450.00	4	4	100	0	0	0	0
Chromium	9.00		47.00	8	8	-	0	0	0	0
Cobalt	4.80		6.50	4	4	100	0	0	0	0
Copper	60.10		445.00	4	4	100	0	0	0	0
Hexavalent chromium	7.50		15.00	2	8	33	1	1	17	17
Manganese	54.50		84.30	4	4	100	0	0	0	0
Mercury	0.12		0.75	3	4	75	0	0	0	0
Nickel	13.70		54.20	4	4	100	0	0	0	0
Iron	13800.00		23400.00	4	4	100	0	0	0	0
Lead	93.80		512.00	4	4	100	0	0	0	0
Magnesium	784.00		1950.00	4	4	100	0	0	0	0
Potassium	540.00		1110.00	4	4	100	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
"A"-Hill Tank Area (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Selenium	1.00		1.00	1	4	25	0	0	0	0
Vanadium	20.00		25.20	4	4	100	0	0	0	0
Zinc	43.00		224.00	4	4	100	0	0	0	0
Lube Oil Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
1-Butanol	1700.00		1700.00	1	25	4	0	0	0	0
2-Butanol	3.00		82.00	7	25	28	0	0	0	0
2-Hexanone	31.00		31.00	1	25	4	0	0	0	0
4-Methyl-2-pentanone	28.00		28.00	1	25	4	0	0	0	0
Carbon disulfide	11.00		11.00	1	25	4	0	0	0	0
Chlorobenzene	2.00		2.00	1	25	4	0	0	0	0
Ethylbenzene	3.00		850.00	8	25	32	0	0	0	0
Hexane	1.00		4500.00	14	25	56	0	0	0	0
Tetrachloroethane	1.00		1.00	1	25	4	0	0	0	0
Toluene	2.00		270.00	4	25	16	0	0	0	0
Xylenes (Total)	8.00		4700.00	10	25	40	0	0	0	0
n-Propylbenzene	4.00		6800.00	8	25	38	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
2,4-Dimethylphenol	250.00		250.00	1	25	4	0	0	0	0
2-Methylnaphthalene	75.00		120000.00	14	25	56	0	0	0	0
4-Methylphenol	210.00		210.00	1	25	4	0	0	0	0
Acenaphthene	130.00		720.00	2	25	8	0	0	0	0
Acenaphthylene	180.00		180.00	1	25	4	0	0	0	0
Anthracene	48.00		1300.00	5	25	20	0	0	0	0
Benzo(a)anthracene	340.00		52000.00	13	25	52	3	0	12	0
Benzo(a)pyrene	81.00		37000.00	12	25	48	11	0	44	0
Benzo(b)fluoranthene	290.00		28000.00	15	25	60	4	0	18	0
Benzo(g,h,i)perylene	390.00		10000.00	8	25	38	0	0	0	0
Benzo(k)fluoranthene	92.00		27000.00	15	25	60	4	0	18	0
Carbazole	280.00		280.00	1	25	4	0	0	0	0
Chrysene	580.00		97000.00	18	25	72	1	0	4	0
Dibenzo(a,h)anthracene	270.00		10000.00	7	25	28	5	0	20	0
Fluoranthene	180.00		9300.00	8	25	38	0	0	0	0
Fluorene	250.00		1500.00	4	25	18	0	0	0	0
Indeno(1,2,3-cd)pyrene	630.00		7800.00	7	25	28	1	0	4	0
Naphthalene	50.00		25000.00	8	25	24	0	0	0	0
Pentachlorophenol	75.00		75.00	1	25	4	0	0	0	0
Phenanthrene	170.00		17000.00	15	25	60	0	0	0	0
Pyrene	210.00		89000.00	20	25	80	0	0	0	0
bis(2-Ethylhexyl)phthalate	870.00		9300.00	3	25	12	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	4.10		85000.00	8	24	33	1	1	4	4
4,4'-DDE	5.40		31.00	4	24	17	0	0	0	0
4,4'-DDT	130.00		48000.00	2	24	8	1	0	4	0

See last page for footnotes.



Table B-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Lube Oil Area (continued)										
<u>Pesticides/PCBs (ug/kg) (continued)</u>										
Aldrin	32.00		32.00	1	24	4	0	0	0	0
Dieldrin	3.80		5600.00	4	24	17	1	0	4	0
Endrin aldehyde	4.80		9.30	2	24	8	0	0	0	0
Endrin ketone	11.00		74.00	2	24	8	0	0	0	0
Heptachlor epoxide	8.80		8.80	1	24	4	0	0	0	0
Methoxychlor	93.00		93.00	1	24	4	0	0	0	0
alpha-Chlordane	12.00		31.00	2	24	8	0	0	0	0
gamma-Chlordane	4.00		1800.00	3	24	13	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	852.00		19000.00	23	24	98	0	0	0	0
Antimony	1.60		8.10	8	24	25	0	0	0	0
Arsenic	4.00		249.00	24	24	100	15	0	63	0
Barium	19.90		302.00	24	24	100	0	0	0	0
Beryllium	0.13		0.88	18	24	75	0	0	0	0
Cadmium	0.11		18.80	14	24	68	0	0	0	0
Calcium	748.00		21600.00	23	24	96	0	0	0	0
Chromium	1.40		138.00	32	34	-	0	0	0	0
Cobalt	1.20		27.70	24	24	100	0	0	0	0
Copper	18.80		322.00	24	24	100	0	0	0	0
Cyanide	3.80		3.80	1	24	4	0	0	0	0
Hexavalent chromium	4.17		4.17	1	28	4	0	0	0	0
Iron	3840.00		89200.00	22	24	92	0	0	0	0
Lead	4.80		1010.00	24	24	100	4	0	17	0
Magnesium	159.00		8900.00	24	24	100	0	0	0	0
Manganese	8.90		418.00	22	24	92	0	0	0	0
Mercury	0.10		9.80	21	24	88	0	0	0	0
Nickel	2.40		91.30	24	24	100	0	0	0	0
Potassium	176.00		8500.00	24	24	100	0	0	0	0
Selenium	0.88		33.30	15	24	83	0	0	0	0
Silver	0.12		0.52	9	24	38	0	0	0	0
Sodium	748.00		5950.00	8	24	25	0	0	0	0
Thallium	1.60		2.60	2	24	8	1	0	4	0
Vanadium	3.10		210.00	24	24	100	0	0	0	0
Zinc	22.70		1100.00	22	24	-	0	0	0	0
Pier No. 1 Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
2-Butanone	4.00		38.00	2	2	100	0	0	0	0
2-Propanol	17.00		17.00	1	2	50	0	0	0	0
Hexane	5.00		5.00	1	2	50	0	0	0	0
Toluene	21.00		21.00	1	2	50	0	0	0	0
Xylenes (Total)	2.00		2.00	1	2	50	0	0	0	0
n-Propylbenzene	25.00		25.00	1	2	50	0	0	0	0

See last page for footnotes.



Table 6-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Pier No. 1 Area (continued)										
<u>Semivolatile Organic Compounds (ug/kg)</u>										
Anthracene	1200.00		1200.00	1	2	50	0	0	0	0
Benzo(a)anthracene	5800.00		5800.00	1	2	50	1	0	50	0
Benzo(a)pyrene	1200.00		4400.00	2	2	100	2	0	100	0
Benzo(b)fluoranthene	1400.00		4700.00	2	2	100	1	0	50	0
Benzo(g,h,i)perylene	1500.00		2800.00	2	2	100	0	0	0	0
Benzo(k)fluoranthene	1400.00		4800.00	2	2	100	1	0	50	0
Chrysene	880.00		8400.00	2	2	100	0	0	0	0
Dibenz(a,h)anthracene	740.00		2000.00	2	2	100	2	0	100	0
Fluoranthene	930.00		4000.00	2	2	100	0	0	0	0
Fluorene	1500.00		1500.00	1	2	50	0	0	0	0
Indeno(1,2,3-cd)pyrene	790.00		2000.00	2	2	100	0	0	0	0
Phenanthrene	590.00		6800.00	2	2	100	0	0	0	0
Pyrene	710.00		4700.00	2	2	100	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	28.00		28.00	1	2	50	0	0	0	0
Endrin	28.00		28.00	1	2	50	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	1880.00		5770.00	2	2	100	0	0	0	0
Arsenic	7.10		37.40	2	2	100	1	0	50	0
Barium	45.20		51.30	2	2	100	0	0	0	0
Beryllium	0.12		0.38	2	2	100	0	0	0	0
Cadmium	0.51		1.80	2	2	100	0	0	0	0
Calcium	5730.00		110000.00	2	2	100	0	0	0	0
Chromium	13.80		13.80	1	2	50	0	0	0	0
Cobalt	5.20		7.50	2	2	100	0	0	0	0
Copper	53.70		143.00	2	2	100	0	0	0	0
Cyanide	0.58		0.58	1	2	50	0	0	0	0
Iron	8800.00		16300.00	2	2	100	0	0	0	0
Lead	98.00		282.00	2	2	100	0	0	0	0
Magnesium	759.00		5680.00	2	2	100	0	0	0	0
Manganese	52.80		680.00	2	2	100	0	0	0	0
Mercury	2.30		21.80	2	2	100	0	0	0	0
Nickel	14.80		15.10	2	2	100	0	0	0	0
Potassium	417.00		803.00	2	2	100	0	0	0	0
Selenium	1.30		1.30	1	2	50	0	0	0	0
Silver	0.41		0.41	1	2	50	0	0	0	0
Vanadium	13.70		23.40	2	2	100	0	0	0	0
Zinc	122.00		281.00	2	2	100	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
No. 2 Tank Field										
<u>Volatile Organic Compounds (ug/kg)</u>										
2-Butanone	39.00		39.00	1	5	20	0	0	0	0
Benzene	290.00		290.00	1	5	20	0	0	0	0
Ethylbenzene	8700.00		8700.00	1	5	20	0	0	0	0
Hexane	3.00		7100.00	4	5	80	0	0	0	0
Toluene	5000.00		5000.00	1	5	20	0	0	0	0
Xylenes (Total)	3.00		38000.00	3	5	80	0	1	0	20
n-Propylbenzene	280.00		6300.00	2	5	40	0	0	0	0
<u>Semi-volatile Organic Compounds (ug/kg)</u>										
2-Methylnaphthalene	510.00		110000.00	4	5	80	0	0	0	0
Benzo(a)anthracene	100.00		1800.00	2	5	40	0	0	0	0
Benzo(a)pyrene	45.00		45.00	1	5	20	0	0	0	0
Benzo(b)fluoranthene	170.00		170.00	1	5	20	0	0	0	0
Benzo(k)fluoranthene	180.00		180.00	1	5	20	0	0	0	0
Chrysene	280.00		2300.00	3	5	80	0	0	0	0
Dibenzo(a,h)anthracene	53.00		53.00	1	5	20	0	0	0	0
Dibenzofuran	3100.00		3100.00	1	5	20	0	0	0	0
Fluoranthene	82.00		82.00	1	5	20	0	0	0	0
Fluorene	1800.00		6700.00	2	5	40	0	0	0	0
Naphthalene	2200.00		39000.00	3	5	80	0	0	0	0
Phenanthrene	100.00		18000.00	5	5	100	0	0	0	0
Pyrene	87.00		14000.00	5	5	100	0	0	0	0
bis(2-Ethylhexyl)phthalate	220.00		2400.00	3	5	60	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDE	7.70		48.00	2	5	40	0	0	0	0
4,4'-DDT	54.00		54.00	1	5	20	0	0	0	0
Aldrin	2.50		2.50	1	5	20	0	0	0	0
Endosulfen sulfate	24.00		24.00	1	5	20	0	0	0	0
Methoxychlor	120.00		120.00	1	5	20	0	0	0	0
alpha-Chlordane	3.00		3.00	1	5	20	0	0	0	0
beta-BHC	5.10		5.10	1	5	20	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	2620.00		14600.00	5	5	100	0	0	0	0
Antimony	8.10		18.20	4	5	80	0	0	0	0
Arsenic	5.50		9.80	5	5	100	0	0	0	0
Barium	18.00		77.70	5	5	100	0	0	0	0
Beryllium	0.28		0.74	5	5	100	0	0	0	0
Cadmium	0.80		0.80	1	5	20	0	0	0	0
Calcium	1950.00		44800.00	5	5	100	0	0	0	0
Chromium	24.80		5150.00	12	12	100	0	0	0	0
Cobalt	8.80		74.60	5	5	100	0	0	0	0
Copper	38.10		118.00	5	5	100	0	0	0	0
Cyanide	0.74		0.74	1	5	20	0	0	0	0
Hexavalent chromium	8.48		255.00	4	10	40	3	3	30	30
Iron	12000.00		53200.00	5	5	100	0	0	0	0
Lead	40.70		851.00	5	5	100	1	0	20	0

See last page for footnotes.



Table 6-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
No. 2 Tank Field (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Magnesium	2080.00		22500.00	5	5	100	0	0	0	0
Manganese	77.20		402.00	5	5	100	0	0	0	0
Mercury	0.14		15.40	4	5	80	0	0	0	0
Nickel	28.50		301.00	5	5	100	0	0	0	0
Potassium	343.00		808.00	5	5	100	0	0	0	0
Selenium	1.30		1.30	1	5	20	0	0	0	0
Silver	0.25		0.78	2	5	40	0	0	0	0
Thallium	1.20		3.70	2	5	40	1	0	20	0
Vanadium	47.30		373.00	5	5	100	0	0	0	0
Zinc	54.70		308.00	5	5	100	0	0	0	0
Asphalt Plant Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
1,1,1-Trichloroethane	2800.00		2800.00	1	7	14	0	0	0	0
2-Butanone	14.00		14.00	2	7	28	0	0	0	0
Benzene	2.00		2.00	1	7	14	0	0	0	0
Chlorobenzene	2.00		6900.00	3	7	43	0	1	0	14
Ethylbenzene	6.00		9.00	2	7	28	0	0	0	0
Hexane	1.00		350.00	3	7	43	0	0	0	0
Toluene	9.00		300.00	2	7	28	0	0	0	0
Xylenes (Total)	7.00		14.00	2	7	28	0	0	0	0
n-Propylbenzene	6.00		40000.00	4	7	57	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
1,4-Dichlorobenzene	4000.00		17000.00	2	8	25	0	0	0	0
2-Methylnaphthalene	2300.00		34000.00	6	8	63	0	0	0	0
Acenaphthene	3100.00		4200.00	2	8	25	0	0	0	0
Anthracene	990.00		3100.00	2	8	25	0	0	0	0
Benzo(a)anthracene	140.00		8300.00	8	8	75	1	0	13	0
Benzo(a)pyrene	970.00		6000.00	4	8	50	4	0	50	0
Benzo(b)fluoranthene	800.00		3100.00	4	8	50	0	0	0	0
Benzo(g,h,i)perylene	970.00		2100.00	3	8	38	0	0	0	0
Benzo(k)fluoranthene	800.00		2900.00	4	8	50	0	0	0	0
Chrysene	190.00		13000.00	6	8	75	0	0	0	0
Dibenzo(a,h)anthracene	380.00		1100.00	2	8	25	1	0	13	0
Dibenzofuran	4300.00		4300.00	1	8	13	0	0	0	0
Fluoranthene	190.00		5800.00	4	8	50	0	0	0	0
Fluorene	2800.00		2800.00	1	8	13	0	0	0	0
Indeno(1,2,3-cd)pyrene	470.00		1800.00	3	8	38	0	0	0	0
Naphthalene	10000.00		10000.00	1	8	13	0	0	0	0
Pentachlorophenol	1400.00		1400.00	1	8	13	0	0	0	0
Phenanthrene	87.00		28000.00	6	8	75	0	0	0	0
Pyrene	500.00		12000.00	7	8	88	0	0	0	0
bis(2-Ethylhexyl)phthalate	580.00		1800.00	3	8	38	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Asphalt Plant Area (continued)										
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	130.00		130.00	1	7	14	0	0	0	0
4,4'-DDE	16.00		34.00	2	7	29	0	0	0	0
4,4'-DDT	58.00		120.00	3	7	43	0	0	0	0
Aroclor-1254	45.00		45.00	1	7	14	0	0	0	0
Aroclor-1260	77.00		77.00	1	7	14	0	0	0	0
Dieldrin	5.90		17.00	3	7	43	0	0	0	0
Endosulfan II	20.00		20.00	1	7	14	0	0	0	0
Endrin aldehyde	88.00		88.00	1	7	14	0	0	0	0
Endrin ketone	3.70		36.00	3	7	43	0	0	0	0
Methoxychlor	65.00		270.00	2	7	29	0	0	0	0
alpha-Chlordane	7.00		39.00	3	7	43	0	0	0	0
gamma-Chlordane	7.40		7.40	1	7	14	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	1320.00		9840.00	7	7	100	0	0	0	0
Antimony	0.64		4.10	7	7	100	0	0	0	0
Arsenic	7.70		120.00	7	7	100	3	0	43	0
Barium	32.20		103.00	7	7	100	0	0	0	0
Beryllium	0.14		0.36	5	7	71	0	0	0	0
Cadmium	0.15		0.15	1	7	14	0	0	0	0
Calcium	883.00		141000.00	7	7	100	0	0	0	0
Chromium	3.90		895.00	13	13	100	0	0	0	0
Cobalt	4.10		24.10	7	7	100	0	0	0	0
Copper	85.10		481.00	7	7	100	0	0	0	0
Hexavalent chromium	5.80		8.86	4	12	33	0	0	0	0
Iron	5460.00		38000.00	7	7	100	0	0	0	0
Lead	118.00		770.00	7	7	100	1	0	14	0
Magnesium	318.00		6150.00	7	7	100	0	0	0	0
Manganese	63.20		266.00	7	7	100	0	0	0	0
Mercury	0.28		1.70	7	7	100	0	0	0	0
Nickel	34.90		92.80	7	7	100	0	0	0	0
Potassium	263.00		1000.00	6	7	86	0	0	0	0
Selenium	1.50		2.00	3	7	43	0	0	0	0
Silver	0.12		0.18	4	7	57	0	0	0	0
Sodium	780.00		1210.00	2	7	29	0	0	0	0
Vanadium	18.80		112.00	7	7	100	0	0	0	0
Zinc	48.20		582.00	7	7	100	0	0	0	0
AV-Gas Tank Field										
<u>Volatile Organic Compounds (ug/kg)</u>										
1-Butanol	280000.00		280000.00	1	8	17	0	0	0	0
Benzene	4.00		12.00	2	8	33	0	0	0	0
Ethylbenzene	1.00		180.00	2	8	33	0	0	0	0
Hexane	2.00		28.00	3	8	50	0	0	0	0
Toluene	2.00		8.00	2	8	33	0	0	0	0
Xylenes (Total)	2.00		78.00	2	8	33	0	0	0	0
n-Propylbenzene	720.00		13000.00	2	8	33	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
AV-Gas Tank Field (continued)										
<u>Semivolatile Organic Compounds (ug/kg)</u>										
2-Chloronaphthalene	1900.00		1900.00	1	6	17	0	0	0	0
2-Methylnaphthalene	120.00		45000.00	4	6	87	0	0	0	0
Acenaphthene	88.00		88.00	1	6	17	0	0	0	0
Anthracene	320.00		2100.00	4	6	87	0	0	0	0
Benzo(a)anthracene	1600.00		9000.00	5	6	83	1	0	17	0
Benzo(a)pyrene	1300.00		12000.00	5	6	83	5	0	83	0
Benzo(b)fluoranthene	1100.00		8400.00	4	6	87	1	0	17	0
Benzo(g,h,i)perylene	860.00		6900.00	4	6	87	0	0	0	0
Benzo(k)fluoranthene	1100.00		8700.00	4	6	87	1	0	17	0
Chrysene	840.00		12000.00	8	6	100	0	0	0	0
Di-n-butyl phthalate	87.00		87.00	1	6	17	0	0	0	0
Dibenzof(a,h)anthracene	760.00		5400.00	2	6	33	2	0	33	0
Dibenzofuran	1600.00		1600.00	1	6	17	0	0	0	0
Fluoranthene	1200.00		5000.00	4	6	87	0	0	0	0
Fluorene	130.00		5000.00	4	6	87	0	0	0	0
Indeno(1,2,3-cd)pyrene	500.00		4800.00	4	6	87	1	0	17	0
Phenanthrene	1200.00		14000.00	5	6	83	0	0	0	0
Pyrene	890.00		11000.00	6	6	100	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDE	14.00		14.00	1	5	20	0	0	0	0
4,4'-DDT	6.90		6.90	1	5	20	0	0	0	0
Aldrin	17.00		17.00	1	5	20	0	0	0	0
Endosulfan I	3.40		3.40	1	5	20	0	0	0	0
Endrin aldehyde	21.00		21.00	1	5	20	0	0	0	0
Endrin ketone	3.90		3.90	1	5	20	0	0	0	0
Methoxychlor	170.00		170.00	1	5	20	0	0	0	0
alpha-Chlordane	5.00		5.00	1	5	20	0	0	0	0
gamma-Chlordane	2.00		2.00	1	5	20	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	1910.00		7500.00	5	5	100	0	0	0	0
Antimony	2.70		59.70	3	5	60	0	0	0	0
Arsenic	5.00		237.00	5	5	100	3	0	80	0
Barium	34.10		75.50	5	5	100	0	0	0	0
Beryllium	0.30		2.00	4	5	80	2	0	40	0
Cadmium	0.35		0.48	2	5	40	0	0	0	0
Calcium	478.00		19100.00	5	5	100	0	0	0	0
Chromium	16.20		1670.00	7	7	100	0	0	0	0
Cobalt	4.50		26.80	5	5	100	0	0	0	0
Copper	94.00		354.00	5	5	100	0	0	0	0
Hexavalent chromium	7.04		79.81	2	6	33	1	1	17	17
Iron	12800.00		46600.00	5	5	100	0	0	0	0
Lead	170.00		5150.00	5	5	100	2	0	40	0
Magnesium	289.00		7150.00	5	5	100	0	0	0	0
Manganese	12.10		309.00	5	5	100	0	0	0	0
Mercury	0.17		0.88	5	5	100	0	0	0	0
Nickel	15.50		140.00	5	5	100	0	0	0	0
Potassium	477.00		893.00	5	5	100	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

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AV-Gas Tank Field (continued)										
<u>Inorganics (mg/kg)</u>										
Selenium	1.00		4.30	4	5	80	0	0	0	0
Silver	0.28		0.53	2	5	40	0	0	0	0
Thallium	3.40		3.40	1	5	20	1	0	20	0
Vanadium	10.50		171.00	5	5	100	0	0	0	0
Zinc	145.00		933.00	5	5	100	0	0	0	0
Exxon Chemicals Plant										
<u>Volatile Organic Compounds (ug/kg)</u>										
Benzene	4.00		43.00	3	5	60	0	0	0	0
Carbon disulfide	2.00		2.00	1	5	20	0	0	0	0
Chlorobenzene	6.00		990000.00	5	5	100	1	2	20	40
Ethylbenzene	4.00		13000.00	3	5	60	0	0	0	0
Hexane	4.00		110000.00	4	5	80	0	0	0	0
Toluene	3.00		11000.00	3	5	60	0	0	0	0
Xylenes (Total)	6.00		48000.00	3	5	60	0	1	0	20
n-Propylbenzene	4.00		1100.00	4	5	80	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
1,2-Dichlorobenzene	4700000.00		4700000.00	1	5	20	0	1	0	20
1,3-Dichlorobenzene	1200.00		1200.00	1	5	20	0	0	0	0
1,4-Dichlorobenzene	820.00		240000.00	3	5	60	0	1	0	20
2-Methylnaphthalene	930.00		12000.00	3	5	60	0	0	0	0
Benzo(a)anthracene	2800.00		27000.00	2	5	40	1	0	20	0
Benzo(a)pyrene	33000.00		33000.00	1	5	20	1	0	20	0
Benzo(b)fluoranthene	1400.00		30000.00	2	5	40	1	0	20	0
Benzo(g,h,i)perylene	13000.00		13000.00	1	5	20	0	0	0	0
Benzo(k)fluoranthene	1400.00		28000.00	2	5	40	1	0	20	0
Chrysene	1300.00		29000.00	4	5	80	0	0	0	0
Dibenz(a,h)anthracene	21000.00		21000.00	1	5	20	1	0	20	0
Fluoranthene	840.00		840.00	1	5	20	0	0	0	0
Fluorene	2700.00		2700.00	1	5	20	0	0	0	0
Indeno(1,2,3-cd)pyrene	13000.00		13000.00	1	5	20	1	0	20	0
Naphthalene	7500.00		240000.00	2	5	40	0	1	0	20
Phenanthrene	980.00		8000.00	4	5	80	0	0	0	0
Pyrene	970.00		4300.00	4	5	80	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDE	5.30		46.00	3	5	60	0	0	0	0
Aldrin	110.00		110.00	1	5	20	0	0	0	0
Endosulfan I	35.00		35.00	1	5	20	0	0	0	0
Endrin ketone	1.70		15.00	2	5	40	0	0	0	0
Methoxychlor	91.00		91.00	1	5	20	0	0	0	0
alpha-Chlordane	39.00		39.00	1	5	20	0	0	0	0
gamma-Chlordane	63.00		63.00	1	5	20	0	0	0	0

See last page for footnotes.



Table 6-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

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Exxon Chemicals Plant (continued)										
<u>Inorganics (mg/kg)</u>										
Aluminum	849.00		3870.00	5	5	100	0	0	0	0
Antimony	1.80		42.50	2	5	40	0	0	0	0
Arsenic	11.00		207.00	5	5	100	4	0	80	0
Barium	6.00		99.80	5	5	100	0	0	0	0
Beryllium	0.07		0.23	3	5	80	0	0	0	0
Cadmium	0.38		0.38	1	5	20	0	0	0	0
Calcium	307.00		20300.00	5	5	100	0	0	0	0
Chromium	3.80		130.00	8	8	100	0	0	0	0
Cobalt	4.40		8.80	5	5	100	0	0	0	0
Copper	110.00		1480.00	5	5	100	1	0	20	0
Cyanide	0.68		0.68	1	5	20	0	0	0	0
Hexavalent chromium	11.84		11.84	1	7	14	1	1	14	14
Iron	8580.00		24800.00	5	5	100	0	0	0	0
Lead	25.80		380.00	5	5	100	0	0	0	0
Magnesium	53.80		3080.00	5	5	100	0	0	0	0
Manganese	16.20		107.00	5	5	100	0	0	0	0
Mercury	0.24		2.00	4	5	80	0	0	0	0
Nickel	21.20		70.80	5	5	100	0	0	0	0
Potassium	439.00		1830.00	4	5	80	0	0	0	0
Selenium	0.93		2.80	4	5	80	0	0	0	0
Silver	0.18		0.47	3	5	60	0	0	0	0
Sodium	789.00		8800.00	2	5	40	0	0	0	0
Thallium	2.70		2.70	1	5	20	1	0	20	0
Vanadium	10.10		368.00	5	5	100	0	0	0	0
Zinc	41.70		475.00	5	5	100	0	0	0	0
No. 3 Tank Field										
<u>Volatile Organic Compounds (ug/kg)</u>										
1-Butanol	780000.00		780000.00	1	14	7	0	0	0	0
2-Butanone	25.00		48.00	3	14	21	0	0	0	0
Acetone	18000.00		18000.00	1	14	7	0	0	0	0
Benzene	5.00		11000.00	5	14	36	0	2	0	14
Carbon disulfide	2.00		2.00	1	14	7	0	0	0	0
Chlorobenzene	10.00		110000.00	5	14	36	0	2	0	14
Ethylbenzene	10.00		36000.00	8	14	43	0	0	0	0
Hexane	23.00		120000.00	7	14	50	0	0	0	0
Toluene	1.00		430.00	5	14	36	0	0	0	0
Xylenes (Total)	7.00		42000.00	8	14	57	0	1	0	7
n-Propylbenzene	48.00		37000.00	10	14	71	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
1,2-Dichlorobenzene	82.00		1800.00	3	14	21	0	0	0	0
1,3-Dichlorobenzene	140.00		140.00	1	14	7	0	0	0	0
1,4-Dichlorobenzene	60.00		16000.00	4	14	28	0	0	0	0
2-Methylnaphthalene	48.00		310000.00	13	14	83	0	0	0	0
Acenaphthene	40.00		2100.00	4	14	28	0	0	0	0

See last page for footnotes.



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No. 3 Tank Field (continued)										
<u>Semivolatile Organic Compounds (ug/kg)</u>										
Anthracene	48.00		130.00	2	14	14	0	0	0	0
Benzo(a)anthracene	200.00		1700.00	7	14	50	0	0	0	0
Benzo(a)pyrene	130.00		2500.00	6	14	43	3	0	21	0
Benzo(b)fluoranthene	370.00		2800.00	6	14	43	0	0	0	0
Benzo(g,h,i)perylene	940.00		2800.00	2	14	14	0	0	0	0
Benzo(k)fluoranthene	420.00		2500.00	8	14	43	0	0	0	0
Carbazole	51.00		51.00	1	14	7	0	0	0	0
Chrysene	350.00		3200.00	7	14	50	0	0	0	0
Di-n-butyl phthalate	150.00		150.00	1	14	7	0	0	0	0
Dibenz(a,h)anthracene	110.00		2300.00	3	14	21	1	0	7	0
Fluoranthene	240.00		2200.00	5	14	38	0	0	0	0
Fluorene	2800.00		5700.00	3	14	21	0	0	0	0
Indeno(1,2,3-cd)pyrene	89.00		1800.00	5	14	38	0	0	0	0
N-Nitrosodiphenylamine(1)	150000.00		150000.00	1	14	7	0	1	0	7
Naphthalene	64.00		91000.00	8	14	57	0	0	0	0
Phenanthrene	310.00		94000.00	12	14	88	0	0	0	0
Pyrene	340.00		3000.00	7	14	50	0	0	0	0
bis(2-Ethylhexyl)phthalate	110.00		890.00	3	14	21	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	4.60		280.00	5	13	38	0	0	0	0
4,4'-DDE	4.30		280.00	10	13	77	0	0	0	0
4,4'-DDT	17.00		290.00	4	13	31	0	0	0	0
Aldrin	2.10		41.00	3	13	23	0	0	0	0
Dieldrin	2.20		9.10	2	13	15	0	0	0	0
Endrin	7.30		7.30	1	13	8	0	0	0	0
Endrin aldehyde	10.00		10.00	1	13	8	0	0	0	0
Endrin ketone	11.00		11.00	1	13	8	0	0	0	0
Methoxychlor	210.00		230.00	2	13	15	0	0	0	0
alpha-BHC	5.60		5.60	1	13	8	0	0	0	0
alpha-Chlordane	2.30		11.00	5	13	38	0	0	0	0
beta-BHC	4.20		4.20	1	13	8	0	0	0	0
gamma-Chlordane	5.00		23.00	4	13	31	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	808.00		13800.00	13	13	100	0	0	0	0
Antimony	1.10		108.00	12	13	92	0	0	0	0
Arsenic	2.00		372.00	13	13	100	7	0	54	0
Barium	7.80		102.00	13	13	100	0	0	0	0
Beryllium	0.14		1.50	8	13	82	1	0	8	0
Calcium	229.00		57400.00	13	13	100	0	0	0	0
Chromium	10.00		4570.00	21	21	100	0	0	0	0
Cobalt	4.30		125.00	13	13	100	0	0	0	0
Copper	13.00		712.00	13	13	100	1	0	8	0
Hexavalent chromium	9.20		293.00	5	16	31	4	4	25	26
Iron	8190.00		65100.00	13	13	100	0	0	0	0
Lead	6.10		2480.00	13	13	100	1	0	8	0
Magnesium	129.00		39400.00	13	13	100	0	0	0	0
Manganese	43.00		492.00	13	13	100	0	0	0	0

See last page for footnotes.



Table 6-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
No. 3 Tank Field (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Mercury	0.16		7.80	10	13	77	0	0	0	0
Nickel	22.40		2850.00	13	13	100	1	0	8	0
Potassium	240.00		1370.00	13	13	100	0	0	0	0
Selenium	1.10		9.20	3	13	23	0	0	0	0
Silver	0.17		0.81	3	13	23	0	0	0	0
Sodium	7120.00		7120.00	1	13	8	0	0	0	0
Thallium	1.10		1.80	2	13	16	0	0	0	0
Vanadium	11.70		613.00	13	13	100	0	0	0	0
Zinc	45.40		421.00	13	13	100	0	0	0	0
General Tank Field										
<u>Volatile Organic Compounds (ug/kg)</u>										
2-Butanone	2.00		65.00	7	24	29	0	0	0	0
4-Methyl-2-pentanone	0.00		160.00	3	24	13	0	0	0	0
Acetone	0.00		170.00	2	24	8	0	0	0	0
Benzene	1.00		420.00	4	24	17	0	0	0	0
Chlorobenzenes	2.00		40.00	3	24	13	0	0	0	0
Chloroform	0.00		43.00	1	24	4	0	0	0	0
Ethylbenzenes	0.00		6600.00	3	24	13	0	0	0	0
Hexane	1.00		9.00	16	24	67	0	0	0	0
Tetrachloroethene	0.00		3.00	1	24	4	0	0	0	0
Toluene	1.00		3900.00	9	24	38	0	0	0	0
Xylenes (Total)	4.00		28000.00	8	24	38	0	1	0	4
n-Propylbenzene	1.00		13000.00	8	24	33	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
2-Methylnaphthalene	59.00		110000.00	11	23	47	0	0	0	0
4-Nitrophenol	0.00		1800.00	1	23	4	0	0	0	0
Acenaphthene	4600.00		11000.00	2	23	8	0	0	0	0
Anthracene	44.00		2500.00	6	23	28	0	0	0	0
Benzo(a)anthracene	140.00		1800.00	18	23	70	0	0	0	0
Benzo(a)pyrene	90.00		1100.00	13	23	57	4	0	17	0
Benzo(b)fluoranthene	88.00		2700.00	18	23	70	0	0	0	0
Benzo(g,h,i)perylene	0.00		420.00	2	23	8	0	0	0	0
Benzo(k)fluoranthene	99.00		2800.00	18	23	70	0	0	0	0
Butyl benzyl phthalate	0.00		220.00	1	23	4	0	0	0	0
Carbazole	0.00		510.00	2	23	9	0	0	0	0
Chrysene	170.00		8400.00	18	23	78	0	0	0	0
Di-n-butyl phthalate	0.00		410.00	3	23	13	0	0	0	0
Dibenzo(a,h)anthracene	0.00		340.00	2	23	9	0	0	0	0
Dibenzofuran	0.00		47.00	1	23	4	0	0	0	0
Fluoranthene	180.00		2300.00	17	23	74	0	0	0	0
Fluorene	71.00		17000.00	3	23	13	0	0	0	0
Indeno(1,2,3-cd)pyrene	53.00		310.00	8	23	28	0	0	0	0
N-Nitrosodiphenylamine(1)	0.00		360.00	1	23	4	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
General Tank Field (continued)										
<u>Semivolatile Organic Compounds (ug/kg) (continued)</u>										
Naphthalene	45.00		24000.00	8	23	38	0	0	0	0
Pentachlorophenol	0.00		9200.00	1	23	4	0	0	0	0
Phenanthrene	89.00		45000.00	18	23	70	0	0	0	0
Pyrene	54.00		15000.00	18	23	83	0	0	0	0
bis(2-Ethylhexyl)phthalate	120.00		2300.00	12	23	52	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	7.80		190.00	10	24	42	0	0	0	0
4,4'-DDE	4.80		38.00	10	24	42	0	0	0	0
4,4'-DDT	4.80		360.00	13	24	54	0	0	0	0
Aldrin	3.00		3.90	2	24	8	0	0	0	0
Dieldrin	4.00		32.00	9	24	38	0	0	0	0
Endosulfan I	0.00		5.40	1	24	4	0	0	0	0
Endrin	0.00		3.70	1	24	4	0	0	0	0
Endrin aldehyde	0.00		28.00	4	24	17	0	0	0	0
Endrin ketone	0.00		9.40	2	24	8	0	0	0	0
Heptachlor epoxide	0.00		24.00	3	24	13	0	0	0	0
Methoxychlor	0.00		210.00	3	24	13	0	0	0	0
alpha-Chlordane	1.50		9.80	3	24	13	0	0	0	0
gamma-Chlordane	2.20		75.00	12	24	50	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	1070.00		18000.00	31	31	100	0	0	0	0
Antimony	0.27		238.00	26	31	84	0	0	0	0
Arsenic	1.80		42.20	31	31	100	7	0	23	0
Barium	24.50		5280.00	31	31	100	0	0	0	0
Beryllium	0.13		1.30	28	31	90	1	0	3	0
Cadmium	0.08		18.40	17	31	55	0	0	0	0
Calcium	882.00		27700.00	31	31	100	0	0	0	0
Chromium	6.10		1680.00	38	38	100	0	0	0	0
Cobalt	3.00		642.00	31	31	100	0	0	0	0
Copper	28.40		1510.00	31	31	100	2	0	8	0
Cyanide	0.84		2.20	11	31	35	0	0	0	0
Hexavalent chromium	1.00		48.10	10	19	53	4	4	21	21
Iron	5230.00		104000.00	31	31	100	0	0	0	0
Lead	11.00		7590.00	31	31	100	12	0	39	0
Magnesium	334.00		28100.00	31	31	100	0	0	0	0
Manganese	25.80		474.00	31	31	100	0	0	0	0
Mercury	0.12		6.00	27	31	87	0	0	0	0
Nickel	15.00		1520.00	31	31	100	0	0	0	0
Potassium	300.00		8100.00	31	31	100	0	0	0	0
Selenium	0.74		9.30	23	31	74	0	0	0	0
Silver	0.24		4.50	18	31	61	0	0	0	0
Sodium	1240.00		35400.00	12	31	39	0	0	0	0
Vanadium	12.30		400.00	31	31	100	0	0	0	0
Zinc	17.80		8080.00	31	31	100	3	0	10	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Solvent Tank Field										
<u>Volatile Organic Compounds (ug/kg)</u>										
Benzene	280.00		290.00	2	4	50	0	0	0	0
Chlorobenzene	200.00		200.00	1	4	25	0	0	0	0
Ethylbenzene	350.00		480.00	2	4	50	0	0	0	0
Hexane	6100.00		6100.00	1	4	25	0	0	0	0
Toluene	250.00		250.00	1	4	25	0	0	0	0
Xylenes (Total)	280.00		280.00	1	4	25	0	0	0	0
n-Propylbenzene	880.00		13000.00	4	4	100	0	0	0	0
<u>SemiVolatile Organic Compounds (ug/kg)</u>										
2-Methylnaphthalene	12000.00		180000.00	4	4	100	0	0	0	0
Acenaphthene	1400.00		8000.00	2	4	50	0	0	0	0
Anthracene	2700.00		11000.00	3	4	75	0	0	0	0
Benzo(a)anthracene	380.00		3400.00	3	4	75	0	0	0	0
Benzo(a)pyrene	520.00		2600.00	2	4	50	1	0	25	0
Benzo(b)fluoranthene	680.00		1400.00	2	4	50	0	0	0	0
Benzo(k)fluoranthene	740.00		1400.00	2	4	50	0	0	0	0
Carbazole	4200.00		4200.00	1	4	25	0	0	0	0
Chrysene	2800.00		5700.00	2	4	50	0	0	0	0
Fluoranthene	600.00		2400.00	2	4	50	0	0	0	0
Fluorene	1800.00		1800.00	1	4	25	0	0	0	0
Naphthalene	2500.00		130000.00	2	4	50	0	1	0	25
Pentachlorophenol	9800.00		9800.00	1	4	25	0	0	0	0
Phenanthrene	2000.00		22000.00	4	4	100	0	0	0	0
Pyrene	3100.00		14000.00	3	4	75	0	0	0	0
bis(2-Ethylhexyl)phthalate	480.00		480.00	1	4	25	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	72.00		72.00	1	4	25	0	0	0	0
4,4'-DDT	75.00		75.00	1	4	25	0	0	0	0
Endosulfan I	18.00		18.00	1	4	25	0	0	0	0
Endosulfan sulfate	24.00		24.00	1	4	25	0	0	0	0
Endrin	10.00		10.00	1	4	25	0	0	0	0
Endrin aldehyde	22.00		22.00	1	4	25	0	0	0	0
Endrin ketone	6.40		7.40	2	4	50	0	0	0	0
alpha-Chlordane	30.00		30.00	1	4	25	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	3220.00		23300.00	4	4	100	0	0	0	0
Antimony	2.80		4.10	2	4	50	0	0	0	0
Arsenic	2.00		48.70	4	4	100	1	0	25	0
Barium	18.40		170.00	4	4	100	0	0	0	0
Beryllium	0.78		0.81	4	4	100	0	0	0	0
Cadmium	0.08		0.34	2	4	50	0	0	0	0
Calcium	3870.00		18500.00	3	4	75	0	0	0	0
Chromium	13.80		424.00	8	7	88	0	0	0	0
Cobalt	18.20		387.00	4	4	100	0	0	0	0
Copper	103.00		1330.00	4	4	100	1	0	25	0

See last page for footnotes.



Table 6-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Solvent Tank Field (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Iron	9090.00		30900.00	4	4	100	0	0	0	0
Lead	20.80		324.00	4	4	100	0	0	0	0
Magnesium	1010.00		6880.00	4	4	100	0	0	0	0
Manganese	51.30		281.00	4	4	100	0	0	0	0
Mercury	0.18		1.30	3	4	75	0	0	0	0
Nickel	90.60		909.00	4	4	100	0	0	0	0
Potassium	807.00		5090.00	4	4	100	0	0	0	0
Selenium	1.30		2.40	2	4	50	0	0	0	0
Silver	0.68		0.68	1	4	25	0	0	0	0
Sodium	3010.00		38300.00	2	4	50	0	0	0	0
Vanadium	21.20		93.80	4	4	100	0	0	0	0
Zinc	38.00		167.00	4	4	100	0	0	0	0
Piers and East Side Treatment Plant Area										
<u>Inorganics (mg/kg)</u>										
Chromium	23.80		28.80	2	2	100	0	0	0	0
Hexavalent chromium	14.81		14.81	1	2	50	1	1	50	50
Domestic Trade Area										
<u>Semivolatile Organic Compounds (ug/kg)</u>										
Anthracene	50000.00		50000.00	1	1	100	0	0	0	0
Carbazole	18000.00		18000.00	1	1	100	0	0	0	0
Chrysene	4100.00		4100.00	1	1	100	0	0	0	0
Fluoranthene	4800.00		4800.00	1	1	100	0	0	0	0
Fluorene	6300.00		6300.00	1	1	100	0	0	0	0
Phenanthrene	9000.00		9000.00	1	1	100	0	0	0	0
Pyrene	8000.00		8000.00	1	1	100	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	81.00		81.00	1	1	100	0	0	0	0
Endrin ketone	10.00		10.00	1	1	100	0	0	0	0
gamma-Chlordane	12.00		12.00	1	1	100	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	5310.00		5310.00	1	1	100	0	0	0	0
Antimony	0.72		0.72	1	1	100	0	0	0	0
Arsenic	16.50		16.50	1	1	100	0	0	0	0
Barium	78.70		78.70	1	1	100	0	0	0	0
Beryllium	0.38		0.38	1	1	100	0	0	0	0
Cadmium	0.28		0.28	1	1	100	0	0	0	0
Calcium	1480.00		1480.00	1	1	100	0	0	0	0
Chromium	8.80		56.10	5	5	100	0	0	0	0
Cobalt	29.30		29.30	1	1	100	0	0	0	0

See last page for footnotes.



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Domestic Trade Area (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Copper	472.00		472.00	1	1	100	0	0	0	0
Iron	15200.00		15200.00	1	1	100	0	0	0	0
Lead	128.00		128.00	1	1	100	0	0	0	0
Magnesium	2800.00		2800.00	1	1	100	0	0	0	0
Manganese	362.00		362.00	1	1	100	0	0	0	0
Mercury	0.81		0.81	1	1	100	0	0	0	0
Nickel	197.00		197.00	1	1	100	0	0	0	0
Potassium	1120.00		1120.00	1	1	100	0	0	0	0
Selenium	1.30		1.30	1	1	100	0	0	0	0
Silver	0.44		0.44	1	1	100	0	0	0	0
Sodium	1510.00		1510.00	1	1	100	0	0	0	0
Vanadium	82.80		82.80	1	1	100	0	0	0	0
Zinc	549.00		549.00	1	1	100	0	0	0	0
Utilities Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
Hexane	2.00		2.00	1	1	100	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
Benzol(a)pyrene	770.00		770.00	1	1	100	1	0	100	0
Benzol(b)fluoranthene	1200.00		1200.00	1	1	100	0	0	0	0
Benzol(k)fluoranthene	1200.00		1200.00	1	1	100	0	0	0	0
Chrysene	1400.00		1400.00	1	1	100	0	0	0	0
Pyrene	1100.00		1100.00	1	1	100	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	82.00		82.00	1	1	100	0	0	0	0
4,4'-DDE	8.80		8.80	1	1	100	0	0	0	0
4,4'-DDT	200.00		200.00	1	1	100	0	0	0	0
Dieldrin	27.00		27.00	1	1	100	0	0	0	0
Methoxychlor	130.00		130.00	1	1	100	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	787.00		787.00	1	1	100	0	0	0	0
Arsenic	4.30		4.30	1	1	100	0	0	0	0
Barium	9.40		9.40	1	1	100	0	0	0	0
Beryllium	0.47		0.47	1	1	100	0	0	0	0
Calcium	254.00		254.00	1	1	100	0	0	0	0
Chromium	3.70		15.80	8	8	100	0	0	0	0
Cobalt	2.10		2.10	1	1	100	0	0	0	0
Copper	17.70		17.70	1	1	100	0	0	0	0
Iron	2840.00		2840.00	1	1	100	0	0	0	0
Lead	122.00		122.00	1	1	100	0	0	0	0
Magnesium	108.00		108.00	1	1	100	0	0	0	0
Manganese	14.70		14.70	1	1	100	0	0	0	0
Nickel	19.40		19.40	1	1	100	0	0	0	0
Vanadium	51.10		51.10	1	1	100	0	0	0	0
Zinc	27.10		27.10	1	1	100	0	0	0	0

See last page for footnotes.



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Main Building Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
Benzene	5.00		5.00	1	8	17	0	0	0	0
Carbon disulfide	4.00		4.00	1	8	17	0	0	0	0
Chlorobenzene	7.00		530.00	2	8	33	0	0	0	0
Ethylbenzene	3.00		570.00	3	8	50	0	0	0	0
Hexane	3.00		1100.00	3	8	50	0	0	0	0
Toluene	3.00		3.00	1	8	17	0	0	0	0
Xylenes (Total)	4.00		1200.00	3	8	50	0	0	0	0
n-Propylbenzene	20.00		11000.00	4	8	87	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
1,2-Dichlorobenzene	780.00		780.00	1	8	17	0	0	0	0
2-Methylnaphthalene	490.00		46000.00	6	8	100	0	0	0	0
Benzo(a)anthracene	390.00		7200.00	2	8	33	1	0	17	0
Benzo(a)pyrene	370.00		8100.00	2	8	33	1	0	17	0
Benzo(b)fluoranthene	850.00		3700.00	2	8	33	0	0	0	0
Benzo(g,h,i)perylene	350.00		8300.00	2	8	33	0	0	0	0
Benzo(k)fluoranthene	600.00		3900.00	2	8	33	0	0	0	0
Chrysene	620.00		12000.00	4	8	87	0	0	0	0
Dibenz(a,h)anthracene	220.00		3300.00	2	8	33	1	0	17	0
Fluoranthene	480.00		480.00	1	8	17	0	0	0	0
Indeno(1,2,3-cd)pyrene	230.00		2300.00	2	8	33	0	0	0	0
Phenanthrene	1500.00		23000.00	4	8	87	0	0	0	0
Pyrene	1700.00		8800.00	4	8	87	0	0	0	0
bis[2-Ethylhexyl]phthalate	2100.00		2800.00	3	8	50	0	0	0	0
<u>Pesticides/PCBs (ug/kg)</u>										
4,4'-DDD	7.20		7.90	2	8	33	0	0	0	0
alpha-Chlordane	13.00		13.00	1	8	17	0	0	0	0
beta-BHC	67.00		67.00	1	8	17	0	0	0	0
<u>Inorganics (mg/kg)</u>										
Aluminum	1380.00		21400.00	8	8	100	0	0	0	0
Antimony	4.50		4.50	1	8	17	0	0	0	0
Arsenic	8.40		225.00	6	8	100	3	0	60	0
Barium	22.90		63.10	6	8	100	0	0	0	0
Beryllium	0.22		0.84	5	8	83	0	0	0	0
Cadmium	0.10		0.68	4	8	87	0	0	0	0
Calcium	1150.00		15900.00	8	8	100	0	0	0	0
Chromium	5.40		1830.00	8	10	80	0	0	0	0
Cobalt	3.30		28.80	6	8	100	0	0	0	0
Copper	81.20		24100.00	6	8	100	1	0	17	0
Hexavalent chromium	13.00		23.88	2	10	20	2	2	20	20
Iron	7200.00		27000.00	8	8	100	0	0	0	0
Lead	47.30		875.00	8	8	100	1	0	17	0
Magnesium	443.00		18800.00	8	8	100	0	0	0	0
Manganese	34.80		230.00	8	8	100	0	0	0	0
Mercury	0.18		0.51	5	8	83	0	0	0	0
Nickel	15.80		125.00	6	8	100	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Main Building Area (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Potassium	300.00		3650.00	6	6	100	0	0	0	0
Selenium	1.50		2.00	2	6	33	0	0	0	0
Silver	0.13		5.10	2	6	33	0	0	0	0
Sodium	1870.00		3400.00	2	6	33	0	0	0	0
Vanadium	11.40		72.80	6	6	100	0	0	0	0
Zinc	63.60		298.00	6	6	100	0	0	0	0
Stockpile Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
2-Butanone	8.00		8.00	1	3	33	0	0	0	0
Chlorobenzene	1.00		1.00	1	3	33	0	0	0	0
Hexane	5.00		7.00	2	3	67	0	0	0	0
Methyl-t-butyl ether	10.00		10.00	1	3	33	0	0	0	0
Xylenes (Total)	2.00		2.00	1	3	33	0	0	0	0
n-Propylbenzene	1.00		14.00	2	3	67	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
2-Methylnaphthalene	480.00		1500.00	2	3	67	0	0	0	0
Acenaphthene	2300.00		2300.00	1	3	33	0	0	0	0
Acenaphthylene	480.00		1100.00	2	3	67	0	0	0	0
Anthracene	440.00		16000.00	3	3	100	0	0	0	0
Benzo(a)anthracene	6500.00		84000.00	3	3	100	3	0	100	0
Benzo(a)pyrene	2200.00		36000.00	3	3	100	3	0	100	0
Benzo(b)fluoranthene	2800.00		85000.00	3	3	100	2	1	67	33
Benzo(g,h,i)perylene	1400.00		14000.00	3	3	100	0	0	0	0
Benzo(k)fluoranthene	2700.00		95000.00	3	3	100	2	0	67	0
Carbazole	3600.00		3600.00	1	3	33	0	0	0	0
Chrysene	4800.00		61000.00	3	3	100	1	0	33	0
Dibenzo(a,h)anthracene	800.00		4800.00	2	3	67	2	0	67	0
Dibenzofuran	3300.00		3300.00	1	3	33	0	0	0	0
Fluoranthene	1200.00		6500.00	3	3	100	0	0	0	0
Fluorene	3400.00		5800.00	2	3	67	0	0	0	0
Indeno(1,2,3-cd)pyrene			14000.00	2	3	67	1	0	33	0
Naphthalene	2000.00		2000.00	1	3	33	0	0	0	0
Phenanthrene	1000.00		84000.00	3	3	100	0	0	0	0
Pyrene	5400.00		120000.00	3	3	100	0	1	0	33
<u>Pesticide/PCBs (ug/kg)</u>										
Dieldrin	15.00		15.00	1	3	33	0	0	0	0
Endrin	13.00		13.00	1	3	33	0	0	0	0
Endrin aldehyde	9.00		9.00	1	3	33	0	0	0	0
Endrin ketone	89.00		89.00	1	3	33	0	0	0	0
Heptachlor epoxide	16.00		16.00	1	3	33	0	0	0	0
Methoxychlor	1500.00		1500.00	1	3	33	0	0	0	0

See last page for footnotes.



Table 6-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
Stockpile Area (continued)										
<u>Inorganics (mg/kg)</u>										
Aluminum	1050.00		8000.00	3	3	100	0	0	0	0
Antimony	5.80		5.80	1	3	33	0	0	0	0
Arsenic	42.80		104.00	3	3	100	3	0	100	0
Barium	28.80		81.50	3	3	100	0	0	0	0
Beryllium	0.09		0.83	3	3	100	0	0	0	0
Cadmium	0.48		0.48	1	3	33	0	0	0	0
Calcium	3370.00		53700.00	3	3	100	0	0	0	0
Chromium	8.70		458.00	8	6	100	0	0	0	0
Cobalt	4.00		10.80	3	3	100	0	0	0	0
Copper	44.80		185.00	3	3	100	0	0	0	0
Cyanide	30.70		30.70	1	3	33	0	0	0	0
Iron	10500.00		18800.00	3	3	100	0	0	0	0
Lead	155.00		331.00	3	3	100	0	0	0	0
Magnesium	525.00		8280.00	3	3	100	0	0	0	0
Manganese	30.30		248.00	3	3	100	0	0	0	0
Mercury	1.30		2.80	3	3	100	0	0	0	0
Nickel	6.50		18.70	3	3	100	0	0	0	0
Potassium	481.00		1370.00	3	3	100	0	0	0	0
Selenium	0.89		4.80	3	3	100	0	0	0	0
Silver	0.19		0.54	2	3	67	0	0	0	0
Sodium	598.00		598.00	1	3	33	0	0	0	0
Vanadium	12.50		15.90	3	3	100	0	0	0	0
Zinc	38.10		208.00	3	3	100	0	0	0	0
MDC Building Area										
<u>Volatile Organic Compounds (ug/kg)</u>										
Ethylbenzene	1.00		1.00	1	1	100	0	0	0	0
Hexene	1.00		1.00	1	1	100	0	0	0	0
Toluene	2.00		2.00	1	1	100	0	0	0	0
Xylenes (Total)	7.00		7.00	1	1	100	0	0	0	0
<u>Semivolatile Organic Compounds (ug/kg)</u>										
Benzo(a)anthracene	200.00		200.00	1	1	100	0	0	0	0
Benzo(a)pyrene	270.00		270.00	1	1	100	0	0	0	0
Benzo(b)fluoranthene	510.00		510.00	1	1	100	0	0	0	0
Benzo(k)fluoranthene	480.00		480.00	1	1	100	0	0	0	0
Chrysene	230.00		230.00	1	1	100	0	0	0	0
Di-n-octyl phthalate	47.00		47.00	1	1	100	0	0	0	0
Fluoranthene	150.00		150.00	1	1	100	0	0	0	0
Naphthalene	84.00		84.00	1	1	100	0	0	0	0
Phenanthrene	150.00		150.00	1	1	100	0	0	0	0
Pyrene	480.00		480.00	1	1	100	0	0	0	0
bis(2-Ethylhexyl)phthalate	1000.00		1000.00	1	1	100	0	0	0	0
Aluminum	7030.00		7030.00	1	1	100	0	0	0	0
Antimony	0.82		0.82	1	1	100	0	0	0	0
Arsenic	10.00		10.00	1	1	100	0	0	0	0
Barium	107.00		107.00	1	1	100	0	0	0	0

See last page for footnotes.



Table 5-7. Summary of Detected Concentrations of All Constituents in Soil Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric ¹ Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Non-Residential Soil Criteria	Number of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria	Percent of Samples Exceeding NJDEP Non-Residential Soil Criteria	Percent of Samples Exceeding NJDEP Impact to Groundwater Soil Criteria
MDC Building Area (continued)										
<u>Inorganics (mg/kg) (continued)</u>										
Beryllium	0.18		0.18	1	1	100	0	0	0	0
Cadmium	0.52		0.52	1	1	100	0	0	0	0
Calcium	21200.00		21200.00	1	1	100	0	0	0	0
Chromium	8.20		37.60	3	3	100	0	0	0	0
Cobalt	8.90		8.90	1	1	100	0	0	0	0
Copper	85.30		85.30	1	1	100	0	0	0	0
Iron	19800.00		19800.00	1	1	100	0	0	0	0
Lead	528.00		528.00	1	1	100	0	0	0	0
Magnesium	4190.00		4190.00	1	1	100	0	0	0	0
Manganese	154.00		154.00	1	1	100	0	0	0	0
Mercury	0.88		0.88	1	1	100	0	0	0	0
Nickel	51.80		51.80	1	1	100	0	0	0	0
Potassium	951.00		951.00	1	1	100	0	0	0	0
Silver	0.10		0.10	1	1	100	0	0	0	0
Sodium	1510.00		1510.00	1	1	100	0	0	0	0
Vanadium	37.80		37.80	1	1	100	0	0	0	0
Zinc	111.00		111.00	1	1	100	0	0	0	0

Ranges of concentrations and exceedances do not include quality assurance/quality control samples such as replicates, field blanks, and matrix spike/matrix spike duplicates.

NJDEP New Jersey Department of Environmental Protection.

PCBs Polychlorinated biphenyls.

mg/kg Milligram per kilogram (parts per million).

ug/kg Microgram per kilogram (parts per billion).

¹ Geometric mean provided only for whole site summary, not for individual area data.



Table 3- 8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Boring Identification/ Well Designation	Borehole and Soil Measurements/Observations			Temporary Well Point Measurements/Observations					NAPL Observations
	Depth of Borehole (ft bla)	Description of Hydrocarbon Observations in Soil	Depth to Saturated Soil (ft bla)	Screened Interval (ft bla)	Days ¹ After Installation	Depth ¹ to Water (ft bmp)	Depth ¹ to NAPL (ft bmp)	Maximum ² Apparent NAPL Thickness (ft)	
<u>"A" - Hill Tank Area</u>									
AHTFSB1	14	HC 3.0 to 3.3 ft bla; at 10.0 to 14.0 ft bla; strong odor.	4	0-10	6	7.38	4.2	3.28	Light brown product.
AHTFSB2	12	HC 0.0 to 6.0 ft bla.	6	0-12	6	4.13	4.03	0.11	Clear light brown product.
AHTFSB3	18	No HC observed; location initially selected for groundwater sample.	10	0-15	14	15.20	14.32	0.88	Clear oil.
AHTFSB4	14	No HC observed.	6	0-10	6	9.16	3.19	6.83	Light brown, clear product.
<u>Lube Oil Area</u>									
LOSB1	16	Trace HC and trace sheen on water 4.0 to 10.0 ft bla.	8	0-10	9	6.89	5.89	1.0	Light brown, clear product.
LOSB2	12	Light HC residuum 2.5 to 3.0 ft bla; semi-residuum 6.0 to 9.0 ft bla.	2.5	0-11	12	3.4	NS	0.05	Brownish/green product.
LOSB3	12	HC 4.0 to 12.0 ft bla.	3	0-10	10	6.24	6.01	0.23	Light brown product.
LOSB4	14	HC 4.0 to 6.0 ft bla. Trace droplets of brown oil.	4	0-10	14	6.29	NS	Trace	No NAPL observed.
LOSB5/ (W) GMMW1	14	Brown HC residuum 2.0 to 10.0 ft bla.	3.7	2.5-12.5	10	4.5	4.0	1.71	Brown clear to dark brown product.
LOSB6	12	No HC observed.	3.5	A				0	No NAPL observed.
LOSB7	8	Brown HC residuum in soil and sheen 2.0 to 6.0 ft bla.	4.3	0-5	12	1.78	NS	Trace	No NAPL observed.
LOSB8	16	HC 2.0 to 12.0 ft bla.	8	0-15	10	10.42	8.42	3.23	Light brown product.
LOSB9	14	Black oily HC-like material with wax-like material 6.0 to 8.0 ft bla.	5.8	0-10	13	6.43	NS	Trace	Thick black oil on bailer, trace floating.
LOSB10	16	HC in sands, 12.0 to 13.5 ft bla.	12	0-10	10	6.23	6.22	0.30	
LOSB11	14	HC 3.0 to 7.0 ft bla.	8.5	0-14	15	4.22	4.1	0.12	Light brown weathered oil.
LOSB12	14	HC on soil 2.0 to 6.0 ft bla; brown fluid HC 6.0 to 12.0 ft bla.	5	0-14	13	5.71	NS	Trace	Brown weathered oil, thin film on probe.
LOSB13	16	HC stains 0.0 to 8.0 ft bla.	8	0-10	9	6.43	NS	0.02	Thick, brown oil on probe.
LOSB14	15	HC 7.0 to 8.5 ft bla. Brown oil.	7	0-15	15	4.42	NS	Trace	No NAPL observed.
LOSB15	12	No HC observed.	2	A				0	No NAPL observed.

See last page for footnotes.



Table 5-8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Borehole and Soil Measurements/Observations				Temporary Well Point Measurements/Observations					
Boring Identification/ Well Designation	Depth of Borehole (ft bls)	Description of Hydrocarbon Observations in Soil	Depth to Saturated Soil (ft bls)	Screened Interval (ft bls)	Days ¹ After Installation	Depth ¹ to Water (ft bmp)	Depth ¹ to NAPL (ft bmp)	Maximum ² Apparent NAPL Thickness (ft)	NAPL Observations
Lube Oil Area (continued)									
LOSB16	14	Trace HC 10.0 to 12.0 ft bls. HC 5.0 to 6.0 ft bls.	10	3-13	15	7.21	7.18	0.03	Brown weathered oil.
LOSB17	3	No HC observed.	NA	A				0	No NAPL observed.
LOSB18	14	Wax bits 2.0 to 10.0 ft bls.	NA	A				0	No NAPL observed.
* LAIRMB1	12	Brown HC residuum 4.0 to 10.0 ft bls.	4	0-10	2	1.87	1.85	0.02	Clear to light brown product.
* LAIRMB2	9	Oil at 1.5 ft bls; spoons coated with oil/water/silt and heavy sheen 4.0 to 8.0 ft bls; odor and sheen.	1.5	0-9	14	4.07	NS	Trace	Light brown product.
* LAIRMB3	12	No HC observed.	4	A				0	No NAPL observed.
* LAIRMB4/ (S) GMMW-19	12	Clayey-like sludge has heavy sheen when wetted 2.0 .	6	0-10	10	3.45	3.32	0.15	Light brown, clear product.
* LAIRMB5	12	Odor, brown HC residuum droplets on spoon 4.0 to 6.0 ft bls; sheen 6.0 to 10.0 ft bls; 10.0 to 12.0 spoon coated with HC residuum. Dark brown, greenish product.	9	0-10	14	5.68	NS	Trace	No NAPL observed.
* LAIRMB6	12	Trace sheen at 12.0 ft bls.	8	A				0	No NAPL observed.
* LAIRMB7	20	Sheens and brown to green HC residuum 8.0 to 16.0 ft bls. Dark brown, greenish product.	7.9	0-15	14	8.15	NS	Trace	No NAPL observed.
Pier No. 1 Area									
PN1SB2	16	HC staining 0.0 to 10.0 ft bls.	8	0-10	7	4.98	NS	0.19	Trace light brown product.
No. 2 Tank Field									
N2TFSB1/ (W) GMMW2	18	Visual HC at 6.0 ft bls. Brown product.	6	6-16	17	4.11	NS	Trace	No NAPL observed.
N2TFSB2	12	Trace HC 4.0 to 8.0 ft bls; saturated 8.0 to 10.0 ft bls.	6	0-10	15	6.14	NS	0.03	Light brown, clear product.
N2TFSB3	14	HC 8.0 to 13.0; trace.	6	0-14	15	7.20	NS	Trace	Trace droplets.
N2TFSB4	12	HC 0.0 to 11.5 ft bls. Sheen of light brown product.	2	0-10	10	5.57	5.54	0.04	Light brown oil.
N2TFSB5	16	HC 4.0 to 8.0 ft bls.	6	0-10	15	7.47	NS	Trace	No NAPL observed.
N2TFSB6	14	No HC observed; stains observed.	6	0-10	15	6.94	6.93	0.02	Droplets of clear product.
APSB1	16	HC 6.0 to 12.0 ft bls. Black product.	10	0-16	12	9.4	NS	Trace	No NAPL observed.

See last page for footnotes.



Table 5-8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Boring Identification/ Well Designation	Borehole and Soil Measurements/Observations			Temporary Well Point Measurements/Observations					NAPL Observations
	Depth of Borehole (ft bla)	Description of Hydrocarbon Observations in Soil	Depth to Saturated Soil (ft bla)	Screened Interval (ft bla)	Days ¹ After Installation	Depth ¹ to Water (ft bmp)	Depth ¹ to NAPL (ft bmp)	Maximum ² Apparent NAPL Thickness (ft)	
<u>Asphalt Plant Area</u>									
APSB2/ (W) GMMW3	20	HC and water 6.0 to 16.0 ft bla.	8	7-17	14	9.02	8.02	3.07	Black thick product.
APSB3	16	Tar-like HC 4.5 to 4.7 ft bla; trace HC residuum and sheen 5.5 to 7.0 ft bla; HC droplets 15.9 to 16.0 ft bla.	6	0-10	13	8.89	NS	Trace	Sheen.
APSB4	12	Tar-like HC 3.5 to 4.0 ft bla; brown HC droplets. Semi-viscous HC residuum, 6.0 to 10.0 ft bla.	8	0-10	11	7.1	6.9	0.2	Thick black weathered oil.
APSB5/ (W) GMMW4	14	Black, thick HC 5.0 to 6.0 ft bla.	9	4-14	17	5.63	NS	Trace	No NAPL observed.
APSB6	20	Hard black HC 3.5 to 6.0 ft bla; saturated with brown HC residuum 8.0 to 10.5 ft bla.	9.5	0-15	10	8.40	8.35	0.05	Thick black tar.
<u>AV-Gas Tank Field</u>									
AGTFSB1	18	HC 0.0 to 4.0 ft bla; saturated HC 4.0 to 14.0 ft bla.	7	0-15	5	10.93	8.94	1.99	Black oil, weathered.
AGTFSB2	12	Black HC 2.0 to 4.0 ft bla.	2	0-10	7	8.46	7.42	2.94	Thick, black product.
AGTFSB3	16	Sheen and HC 2.0 to 9.0 ft bla.	8	0-10	13	6.58	6.52	1.09	Light brown product.
AGTFSB4	14	HC 4.0 to 12.0 ft bla.	7	0-10	15	9.06	8.34	0.72	Black weathered oil.
<u>Exxon Chemical Plant</u>									
ECPSB1	20	Droplets to saturated with brown HC residuum 10.0 to 12.0 ft bla.	11	0-15	5	10.32	8.8	1.52	Light brown, clear product.
ECPSB2	20	Sheen and trace black to brown HC residuum 4.0 to 12.0 ft bla, and at 20.0 ft bla.	10	0-20	14	10.36	8.78	1.58	Brown oil.
ECPSB3	4	No HC observed; Refusal at 4.0 ft bla.	NA	A				0	No NAPL observed.
ECPSB4	8	Stiff tar and black viscous residuum; sheen on water 6.0 to 8.0 ft bla; called trace on field forms. Droplets.	6	0-8	14	7.72	NS	Trace	No NAPL observed.
ECPSB5	18	Saturated with brown HC residuum 6.0 to 14.0 ft bla.	6	0-10	13	6.48	NS	0.11	Black oil.
* ECIRMB1	16	No HC observed.	6	A				0	No NAPL observed.
* ECIRMB2/ (S) GMMW-18	12	Sheens and trace black to green HC residuum 2.0 to 8.0 ft bla.	4	0-10	7	5.09	4.39	0.55	Brown to light brown semi-clear oil.

See last page for footnotes.



Table 5-8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Borehole and Soil Measurements/Observations				Temporary Well Point Measurements/Observations					NAPL Observations
Boring Identification/ Well Designation	Depth of Borehole (ft bla)	Description of Hydrocarbon Observations in Soil	Depth to Saturated Soil (ft bla)	Screened Interval (ft bla)	Days ¹ After Installation	Depth ¹ to Water (ft bmp)	Depth ¹ to NAPL (ft bmp)	Maximum ² Apparent NAPL Thickness (ft)	
<u>Exxon Chemical Plant (continued)</u>									
* ECIRMB3	12	Brown HC residuum 3.5 to 6.6 ft bla.	4	0-10	5	4.34	3.96	0.38	Light clear product.
EC2SB1	16	HC 2.0 to 12.0 ft bla.	14	5-15	10	9.20	8.04	1.16	
<u>No. 3 Tank Field</u>									
N3TFSB1/ (W) GMMW5	14	Sheen 4.0 to 6.0 ft bla; HC residuum 8.0 to 13.0 ft bla.	10	3-13	21	11.63	4.32	8.29	Light brown product.
N3TFSB2	12	Saturated with brown HC residuum 4.0 to 11.5 ft bla.	5	0-9	15	6.12	NS	Trace	No NAPL observed.
N3TFSB3/ (W) GMMW6	16	Light brown weathered product.	6.5	4-14	18	10.10	NS	Trace	No NAPL observed.
N3TFSB4	14	Very trace sheen; groundwater sample collected but standpipe left in ground to measure HC, if present.	4.5	0-10				0	No NAPL observed.
N3TFSB5	12	No HC observed.	8	A				0	No NAPL observed.
N3TFSB6	12	Saturated with HC residuum 3.5 to 6.0 ft bla; sheens 2.3 to 8.0 ft bla. Sheen.	2.3	3-8	17	5.1	NS	Trace	No NAPL observed.
N3TFSB7	12	Slippery soil, sheen, and trace HC 4.0 to 6.0 ft bla. Light brown clear product.	3.5	0-10	17	2.01	NS	Trace	No NAPL observed.
N3TFSB8/ (W) GMMW7	16	Red to brown HC residuum 4.0 to 6.0 ft bla; sheen 6.0 to 10.0 ft bla.	4	3-13	21	7.70	3.05	4.65	Light brown clear product. After well development, product more readily entered well.
N3TFSB9	8	No HC observed.	NA	0-8	3	1.46	NS	0	No NAPL observed.
* 3TFIRMB1/ (S) GMMW-16	16	Light brown HC residuum coating drill rods; HC is difficult to see on soil which is a brown sand.	2.5	0-15	6	10.23	5.21	6.1	Light brown, clear.
* 3TFIRMB2	12	Brown HC residuum mixed with water, HC residuum, and sheens 4.0 to 9.0 ft bla.	4	0-8	4	6.68	6.03	0.65	Light brown, clear product.
* 3TFIRMB3/ (S) GMMW-17	18	Cinders saturated with light black HC residuum 2.5 to 4.0 ft bla.	2.5	0-10	13	3.27	3.11	0.16	Similar to product in 3TFIRMB1.
* 3TFIRMB4	12	Brown HC residuum and residuum droplets 4.0 to 10.0 ft bla.	4	0-10	4	5.88	5.47	0.41	Light brown clear product.
<u>General Tank Field</u>									
GTFSB1/ (W) GMMW8	20	Saturated with HC 6.0 to 8.0 ft bla; field log states possible 2 ft floating product. Semi-viscous brown HC residuum. Black oil, weathered, tar-like, heavy black oil.	6	3-16	16	5.19	NS	Trace	No NAPL observed.



Table 5-8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Boring Identification/ Well Designation	Borehole and Soil Measurements/Observations			Temporary Well Point Measurements/Observations					NAPL Observations
	Depth of Borehole (ft bla)	Description of Hydrocarbon Observations in Soil	Depth to Saturated Soil (ft bla)	Screened Interval (ft bla)	Days ¹ After Installation	Depth ¹ to Water (ft bmp)	Depth ¹ to NAPL (ft bmp)	Maximum ² Apparent NAPL Thickness (ft)	
General Tank Field (continued)									
GTFSB2	16	Saturated with brown HC residuum 3.0 to 8.0 ft bla; sheen and droplets 8.0 to 13.0 ft bla. (Black oil.)	6	0-14	11	5.63	5.39	0.24	Black oil.
GTFSB3/ (W) GMMW9	16	Heavy sheens 4.0 to 12.0 ft bla; HC saturation 7.5 to 8.0 ft bla. Residuum, droplets.	7.5	3-13	16	5.16	5.15	0.01	Black oil.
GTFSB4	16	Sticky tar-like black HC, sheen, droplets 5.5 to 13.9 ft bla. (Black oil.)	5	0-15	13	7.33	NS	Trace	No NAPL observed.
GTFSB5	16	Trace sheen droplets 8.0 to 15.0 ft bla. Black oil.	8	0-15	13	7.08	NS	Trace	No NAPL observed.
GTFSB6/ (W) GMMW10	16	Saturated with coal tar 6.0 to 13.8 ft bla.	6	3-13	15	5.2	5.1	0.3	Semi-viscous brown HC residuum. Tar-like; black oil, very viscous.
GTFSB7	16	Tar 7.3 to 10.0 ft bla; sheen and droplets 10.0 to 12.0 ft bla.	5.7	0-15	13	5.96	NS	0.02	Black oil.
GTFSB8	16	Gummy HC 2.0 to 6.0 ft bla; coal tar saturated 6.0 to 10.5 ft bla.	6	0-15	5	8.2	NS	1.2	Black viscous oil.
GTFSB9	16	Saturated with tar 4.0 to 10.0 ft bla; heavy sheen 10.0 to 16.0 ft bla.	5.8	0-15	7 *	8.18	6.15	2.07	Semi-viscous brown HC residuum. Black viscous oil, measured with tape and probe.
EGTFSB1	14	Visual HC and staining 6.0 to 10.0 ft bla. Sheen on water table, strong odor.	6	0-14	11	4.33	NS	Trace	No NAPL observed.
* GTFIRMB1	16	Brown HC residuum stains spoon, moist, 6.3 to 7.2 ft bla. (black thick product).	7.2	0-10	14	6.54	NS	Trace	No NAPL observed.
* GTFIRMB2	14	HC visible on drill rods, on soil, and on water 4.0 to 9.0 ft bla. (black oil).	4	0-5	17	8.84	NS	Trace	No NAPL observed.
* GTFIRMB3	16	Cinders are lightly coated with brown HC residuum, trace sheen 8.0 to 13.0 ft bla. (black thick product).	10	0-10	15	8.39	NS	Trace	No NAPL observed.
* GTFIRMB4	18	Pinkish oil HC 4.0 to 8.0 ft bla. (droplets and black oily material).	6	0-10	17	6.87	NS	Trace	No NAPL observed.
* GTFIRMB5/ (S) GMMW-20	24	Adhesive tar-like stiff black HC 4.0 to 6.0 ft bla; heavy sheen on water 4.0 to 10.0 ft bla; pure brown HC residuum 6.0 to 22.0 ft bla.	2	0-20	14	5.89	NS	0.03	Black HC droplets on bailer; dark black tar-like HC on probe.
* GTFIRMB6	20	Silty black to gray metallic luster material 2.0 to 4.0 ft bla; clear to brown HC residuum gives sheen; sheen on water 10.0 to 19.0 ft bla.	9	0-15	14	5.34	NS	0.02	Black, viscous product.



Table 5-8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Borehole and Soil Measurements/Observations				Temporary Well Point Measurements/Observations					NAPL Observations
Boring Identification/ Well Designation	Depth of Borehole (ft bls)	Description of Hydrocarbon Observations in Soil	Depth to Saturated Soil (ft bls)	Screened Interval (ft bls)	Days ¹ After Installation	Depth ¹ to Water (ft bmp)	Depth ¹ to NAPL (ft bmp)	Maximum ² Apparent NAPL Thickness (ft)	
General Tank Field (continued)									
* GTFIRMB7	20	HC saturated 6.0 to 8.0 ft bls. HC droplets.	8	5-10	9	4.70	NS	Trace	No NAPL observed.
* GTFIRMB8	20	HC 7.5 to 12.0 ft bls; sheen on water and spoon 12.0 to 20.0 ft bls. (black, thick).	10	5-15	10	7.16	NS	Trace	No NAPL observed.
* GTFIRMB9	12	No HC observed; groundwater sample was collected from this IRM boring.	6	A				0	No NAPL observed.
* GTFIRMB10	16	No HC observed.	6	A				0	No NAPL observed.
* GTFIRMB11	8	No HC observed.	4	A				0	No NAPL observed.
* GTFIRMB12	12	No HC observed.	6	A				0	No NAPL observed.
* GTFIRMB13	16	No HC observed.	6.5	A				0	No NAPL observed.
* GTFIRMB14	18	No HC observed.	8	A				0	No NAPL observed.
* GTFIRMB15	12	Trace black bound HC smeared on gloves 2.0 to 4.0 ft bls and 8.0 to 10.0 ft bls.	4	A				0	No NAPL observed.
* GTFIRMB16	12	Very trace sheen on water pouring from spoons 6.0 to 12.0 ft bls.	4	0-10	13	4.42	4.41	Trace	Sheen.
* GTFIRMB17	10	No HC observed.	5.5	A				0	No NAPL observed.
* GTFIRMB18	18	Black to brown HC in soil 6.0 to 12.0 ft bls.	6	0-10	13	4.7	NS	Trace	No NAPL observed.
Solvent Tank Field									
STFSB1	14	Visual HC 2.0 to 12.0 ft bls.	2	0-10	13	6.24	6.17	0.11	
STFSB2	16	Visual HC 4.0 to 14 ft bls.	4	0-10	12	4.28	4.26	0.02	
STFSB3	14	Visual HC 4.0 to 10.0 ft bls.	4	0-10	12	4.96	NS	0.01	
GFSB1/ (W) GMMW14	16	Heavy black oil and oily cinders 4.0 to 8.0 ft bls.	7	4-14	14	5.35	NS	Trace	No NAPL observed.
Piers and East Side Treatment Plant Area									
PESTSB1	20	HC residuum, iridescent sheen 4.0 to 8.0 ft bls.	10	0-10	6	7.11	7.1	0.01	
PESTSB2	20	HC residuum in a silty slurry 8.0 to 12.0 ft bls.	10	0-10	6	6.54	6.38	0.16	

See last page for footnotes.



Table 5-8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Borehole and Soil Measurements/Observations				Temporary Well Point Measurements/Observations					NAPL Observations
Boring Identification/ Well Designation	Depth of Borehole (ft bls)	Description of Hydrocarbon Observations in Soil	Depth to Saturated Soil (ft bls)	Screened Interval (ft bls)	Days ¹ After Installation	Depth ¹ to Water (ft bmp)	Depth ¹ to NAPL (ft bmp)	Maximum ² Apparent NAPL Thickness (ft)	
<u>Domestic Trade Area</u>									
DTSB1/ (W) GMMW11	18	No visual HC observed.	8	5.5-15	13	7.3	NS	Trace	No NAPL observed.
DTSB2	18	HC staining .0 to 4 ft bls; visual HC 6.0 to 6.5 ft bls.	6	0-15	13	6.19	6.05	0.3	
DTSB3	14	Black HC 2 to 6.0 ft bls.	2	0-14	11	4.42	NS	Trace	No NAPL observed.
<u>Main Building Area</u>									
MBSB1	16	Visual HC 6.0 to 10.0 ft bls.	6	0-15				0	No NAPL observed.
MBSB2	24	HC 8.0 to 22.0 ft bls coating inside and outside of spoons and squeezed from soils.	16	0-20	13	16.62	8.99	8	No NAPL observed.
MBSB3	22	Droplets to trace brown to black HC residuum in soils 8.0 to 12.0 ft bls; spoon full of HC residuum 12.0 to 21.0 ft bls.	12	0-20	14	13.47	13.39	0.11	
MBSB4	16	HC 7.0 to 12.0 ft bls; sheen 12.0 to 14.0 ft bls.	10	0-15	17	14.2	NS	Trace	No NAPL observed.
PSSB1	6	HC 0.0 to 4.0 ft bls.	5	0-10	9	6.97	NS	Trace	No NAPL observed.
<u>Stockpile Area</u>									
SSB1	24	Trace HC 10.0 to 16.0 ft bls.	18	0-20	15	19.11	18.21	1.25	
SSB2/ (W) GMMW12	16	Greenish HC 2.0 to 10.0 ft bls.	4	3-13	9	7.34	NS	Trace	
SSB3	12	Trace HC 8.0 to 9.5 ft bls.	8.5	0-10	11	6.62	NS	Trace	No NAPL observed.
<u>Utilities Area</u>									
T998SB1/ (W) GMMW13	16	HC residuum 2.0 to 8.0 ft bls.	2	3-13	9	5.01	NS	Trace	
<u>MDC Building Area</u>									
MDCSB1	14		8	0-10	13	7.04	7.0	0.14	
MDCSB2/ (W) GMMW15	17	HC-stained-cinders below water table.	10	6-16	15	6.73	6.68	0.05	

See last page for footnotes.



Table 5-8. Hydrocarbon and NAPL Observations in Soil and Temporary Well Points Installed During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Unless otherwise noted, all soil borings and monitoring wells listed in this table were installed during the Phase IA RI.

¹	Depth to NAPL and depth to water as measured in a well point or monitoring well on the last measurement event prior to borehole abandonment or conversion to a monitoring well.
²	Maximum apparent NAPL thickness measured during the monitoring period (periodic measurements were collected at various intervals throughout the approximately 2-week monitoring period).
*	Denotes a soil boring and/or monitoring well installed as part of the NAPL IRM investigation at the General Tank Field, No. 3 Tank Field, Exxon Chemical Plant (Utilities Area), and Lube Oil Area.
NAPL	Non-aqueous phase liquid.
ft bls	Feet below land surface.
ft bmp	Feet below measuring point, which is the top of the temporary well point at approximately land surface.
ft	Feet.
HC	Hydrocarbon. Descriptions in this table are based primarily on visual observations made by the field geologist, with assistance from other knowledgeable field personnel. Most descriptions of hydrocarbons in soil are augmented by field screening data collected using an organic vapor analyzer (OVA).
NS	No signal from product interface probe, indicating that NAPL is not present or is not measurable with the probe. The probe usually cannot indicate/measure a NAPL layer that is too thin or that is in separate globules or droplets.
Trace	Trace less than 0.01 foot; represented by a sheen; not measurable using an oil/water interface probe.
A	Temporary drivepoint installed.
(S)	Temporary well point.
(W)	Well.
IRM	Interim Remedial Measure.

NAPL measurements for Monitoring Wells GMMW1 through GMMW15 were taken only from the 4-inch permanent monitoring well that was installed immediately after the boring was drilled.

NAPL measurements for Monitoring Wells GMMW16 through GMMW20 were initially taken from the 2-inch temporary well point that was installed immediately after the boring was drilled (measurements indicated by S).

NOTE: In certain instances, NAPL was observed in a temporary drivepoint intended for groundwater sampling. In these instances, groundwater samples were not obtained and the drivepoint was measured for NAPL in the same fashion as the temporary well points.



Table 5-9. Hydrometer Test Results, Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Location I.D.	Apparent ¹ NAPL Thickness (ft)	Specific Gravity
GMMW1	0.73	0.885
GMMW5	4.67	0.853
GMMW7	4.81	0.841
GMMW16	4.12	0.830
GMMW18	0.95	0.870
AHTFSB1	3.28	0.820
AHTFSB4	6.83	0.820
MBSB2	8.0	0.820
GTFSB9	2.07	0.960
EC2SB1	1.16	0.968
ECPSB2	1.58	0.970
AGTFSB3	1.09	0.965
AGTFSB4	0.72	0.970
SSB1	1.25	0.916
ITMW1	9.90	0.830
ITMW2	2.98	0.870
ITMW4	0.25	0.971
P7MW1	1.72	0.900
SHERI3	0.5	0.936
MW3	7.74	0.807
MW7	1.38	0.790
MW8	13.6	0.832
MW12	8.53	0.797
MW13	10.14	0.802
PKMW8	0.21	0.945
PKMW11	9.29	0.882
PKMW12	9.34	0.870
PKMW14	0.75	0.920
EB2	1.05	0.901
EB3	1.08	0.901
EB12	4.18	0.910
EB13	0.52	0.995
EB16	1.71	0.885
EB17	0.02	0.918
EB19	2.01	0.907
EB24	0.13	0.895
EB59	1.01	0.862
EB62	2.45	0.991
EB69	3.57	0.990

See last page for footnotes.



Table 5-9. Hydrometer Test Results, Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Location I.D.	Apparent ¹ NAPL Thickness (ft)	Specific Gravity
EB72	0.64	0.851
EB73	0.54	0.940
EB76	0.74	0.889
EB80	3.9	0.800
EB81	0.15	0.990
EB104	0.73	0.917
EB106	0.70	0.927
EBR5	1.7	0.885
EBR12	1.03	0.865
EBR18	1.05	0.852

¹ NAPL samples were collected from RI/IRM standpipes or monitoring wells. Presented NAPL thicknesses are the maximum NAPL thickness measured at each location from temporary well points or at monitoring wells during the December 12, 1994 low-tide synoptic water/NAPL measuring event.

NAPL Non-aqueous phase liquid.
 ft Feet.
 RI Remedial investigation.
 IRM Interim remedial measure.



Table 5-10. Summary of NAPL Findings, Bayonne Plant, Bayonne, New Jersey

Descriptive Location or Operational Area	Plume No. (See Figure 5-5)	Apparent NAPL Thickness Range (feet)	Specific Gravity Range	Inferred NAPL Type *	Currently Subject to IRM	Deferred to RI
Pier 5 and East Side, Treatment Plant Area, and MDC Building Area	1, 2, and 3	0.16 - 3.57	0.851 - 0.991	Degraded gasolines and diesel, kerosene, No. 5 and No. 6 fuel oils, and high viscosity lube base stock..	X	--
Low Sulfur and Solvent Tank Fields	4	0.15 - 13.6	0.797 - 0.99	Gasoline and heavy fuel oils (e.g., No. 6 fuel oil).	X	--
General Tank Field	5 and 6	0.24 - 2.07	0.960	No. 6 fuel oil.	--	X
AV-Gas Tank Field and Domestic Trade Area (includes southern part of Interceptor Trench)	7	0.20 - 9.9	0.83 - 0.970	Diesel/aviation fuel; lube oil and No. 6 fuel oils.	X	--
Asphalt Plant and Exxon Chemicals Plant (includes Utilities Area)	8 and 9	0.11 - 4.67	0.853 - 0.970	Lube oil, No. 6 oil, and asphalt.	X	X
No. 3 Tank Field	10	0.16 - 4.81	0.830 - 0.841	Kerosene or cutback naphtha/powerformer feedstock.	X	--
No. 2 Tank Field and Main Building Area (includes northern Interceptor Trench area)	11 and 12	0.10 - 2.98	0.87 - 0.971	Diesel; No. 2 and No. 6 fuel oils.	X	--
"A"-Hill Tank Field	13	0.11 - 8.0	0.82	Diesel.	--	X
Lube Oil and Stockpile Area (includes Platty Kill Canal)	14, 15, and 16	0.11 - 3.23	0.885 - 0.945	Lube oil and No. 2 fuel oil.	X	X
Pier No. 1 (includes Helipad Area)	17	0.38 - 4.18	0.885 - 0.995	Lube oil/No. 6 oil.	X	--

* Based on specific gravity measurements and operating characteristics.

NAPL Non-aqueous phase liquid.
 IRM Interim remedial investigation.
 RI Remedial investigation.
 AV Aviation gasoline.
 MDC Metropolitan Distribution Center.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: EB1	EB29	EB51	EB68	EBR13	EBR19	GMMW2	GMMW3	GMMW4	GMMW6	GMMW8
		Date: 01/26/95	01/26/95	01/25/95	01/24/95	01/27/95	01/24/95	01/25/95	01/25/95	01/25/95	01/25/95	01/23/95
Total Petroleum Hydrocarbons (mg/L)	1.0 **	17.4	6.62	25.3	10.7	10.2	12.9	16.9	42.1	13.9	16.6	21.5
Volatile Organic Compounds (ug/L)												
1,1,1-Trichloroethane	30	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,1,2,2-Tetrachloroethane	2	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ
1,1,2-Trichloroethane	3	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,1-Dichloroethane	70	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,1-Dichloroethene	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,2-Dibromoethane	--	20U	20U	20U	20UJ	20U	20UJ	20U	20U	20U	20U	20U
1,2-Dichloroethane	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,2-Dichloroethene(Total)	110	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,2-Dichloropropane	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1-Butanol	--	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U
2-Butanol	--	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U
2-Butanone	300	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ
2-Hexanone	100 **	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ
2-Methyl-2-propanol	500 **	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U
2-Propanol	--	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U
4-Methyl-2-pentanone	400	10U	10U	10U	10UJ	10U	10UJ	10U	10U	10U	10U	10U
Acetone	700	10UJ	10UJ	10UJ	10UJ	49J	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ
Benzene	1	10U	10U	10U	10U	10U	10U	8J	27	10U	10U	10U
Bromodichloromethane	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Bromoform	4	10UJ	10UJ	10U	10U	10U	10U	10UJ	10U	10U	10U	10U
Bromomethane	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Carbon disulfide	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Carbon tetrachloride	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Chlorobenzene	4	10U	10U	11U	18	10U	10U	3U	7100	12U	10U	10U
Chloroethane	100 **	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Chloroform	6	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Chloromethane	30	10U	10U	10UJ	10U	10UJ	10U	10U	10UJ	10UJ	10UJ	10U
cis-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Dibromochloromethane	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: EB1	EB29	EB51	EB68	EBR13	EBR19	GMMW2	GMMW3	GMMW4	GMMW6	GMMW8
		Date: 01/26/95	01/26/95	01/25/95	01/24/95	01/27/95	01/24/95	01/25/95	01/25/95	01/25/95	01/25/95	01/23/95
Ethylbenzene	700	10U	10U	10U	10U	10U	10U	19	9J	10U	10U	10U
Hexane	--	20UJ	20UJ	20U	20UJ	20U	20UJ	28J	20U	20U	20U	20U
Methyl-t-butyl ether	700 **	20U	20U	20U	20UJ	20U	20UJ	20U	20U	20U	20U	20U
Methylene chloride	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
n-Propylbenzene	--	2J	20U	20U	20U	20U	20U	16J	4J	20U	20U	20U
Styrene	100	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Tetrachloroethene	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Toluene	100	10U	10U	10U	10U	10U	10U	5J	2J	10U	10U	10U
trans-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Trichloroethene	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Vinyl chloride	5	10U	10U	10UJ	10U	10U	10U	10U	10UJ	10UJ	10UJ	10U
Xylenes (Total)	40	10U	10U	10U	10U	10U	10U	59	5J	10U	10U	10U
Total VOCs		2	0	0	18	49	0	138	7147	0	0	0

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW9	GMMW10	GMMW11	GMMW13	GMMW14	GMMW15	GMMW17	GMMW19	GMMW20	GMMW21	GMMW21D
		Date: 01/23/95	01/23/95	01/25/95	01/27/95	01/23/95	01/24/95	01/25/95	01/27/95	01/23/95	01/26/95	01/24/95
Total Petroleum Hydrocarbons (mg/L)	1.0 **	<u>5.02</u>	<u>121</u>	<u>4.25</u>	<u>24.2</u>	<u>4.43</u>	<u>40.2</u>	<u>7.25</u>	<u>19.2</u>	<u>6.64</u>	<u>1.85</u>	0.68
Volatile Organic Compounds (ug/L)												
1,1,1-Trichloroethane	30	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
1,1,2,2-Tetrachloroethane	2	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	100	310UJ
1,1,2-Trichloroethane	3	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
1,1-Dichloroethane	70	10U	10U	10U	64	10U	10U	10U	10U	10U	62J	310U
1,1-Dichloroethane	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
1,2-Dibromoethane	--	20U	20U	20U	20U	20U	20U	20U	20U	20U	200U	620U
1,2-Dichloroethane	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
1,2-Dichloroethane(Total)	110	10U	10U	10U	7J	7J	10U	10U	10U	10U	<u>830</u>	310U
1,2-Dichloropropane	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
1-Butanol	--	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	24000J
2-Butanol	--	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	16000UJ
2-Butanone	300	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	100	310UJ
2-Hexanone	100 **	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	100	310UJ
2-Methyl-2-propanol	500 **	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	16000UJ
2-Propanol	--	500U	500U	500U	500U	500U	500U	500U	500U	500U	500U	16000UJ
4-Methyl-2-pentanone	400	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Acetone	700	10UJ	10UJ	10UJ	10UJ	10UJ	19J	10UJ	10UJ	10UJ	100	<u>4300J</u>
Benzene	1	10U	10U	10U	<u>6J</u>	<u>7J</u>	<u>10</u>	<u>5J</u>	<u>12</u>	<u>2J</u>	<u>11J</u>	310U
Bromodichloromethane	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Bromoform	4	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Bromomethane	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Carbon disulfide	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Carbon tetrachloride	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Chlorobenzene	4	2J	10U	10U	10U	2J	10U	1U	10U	10U	100	310U
Chloroethane	100 **	10U	10U	10U	65	10U	10U	10U	10U	10U	100	310U
Chloroform	6	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310UJ
Chloromethane	30	10U	10U	10UJ	10UJ	10U	10U	10U	10UJ	10U	100	310UJ
cis-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Dibromochloromethane	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW9	GMMW10	GMMW11	GMMW13	GMMW14	GMMW15	GMMW17	GMMW19	GMMW20	GMMW21I	GMMW21D
		Date: 01/23/95	01/23/95	01/25/95	01/27/95	01/23/95	01/24/95	01/25/95	01/27/95	01/23/95	01/26/95	01/24/95
Ethylbenzene	700	10U	10U	10U	10U	3J	10U	10U	10U	2J	100	620U
Hexane	--	20U	20U	20U	20U	20U	20U	20U	20U	20U	200U	620U
Methyl-t-butyl ether	700 **	20U	20U	20U	20U	20U	20UJ	20UJ	20U	20U	200U	310U
Methylene chloride	2	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
n-Propylbenzene	--	20U	6J	20U	20U	20U	7J	20U	20U	20U	200U	620U
Styrene	100	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Tetrachloroethene	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	<u>820</u>	310U
Toluene	100	1J	10U	10U	10U	2J	2J	10U	2J	10U	100	310U
trans-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U	10U	10U	10U	100	310U
Trichloroethene	1	1J	10U	10U	10U	10U	10U	10U	10U	10U	<u>1100</u>	310U
Vinyl chloride	5	10U	10U	10UJ	10U	3J	10U	10U	10U	10U	<u>370</u>	310U
Xylenes (Total)	40	10U	10U	10U	10U	2J	7J	3J	4J	7J	100	310U
Total VOCs		4	6	0	142	92	45	9	18	11	3193	28300

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW22D	GMMW23I	GMMW23D	GMMW23DFR	GMMW24I	GMMW24IFR	GMMW24D	MW6	MW9	MW10
Analyte		Date: 01/27/95	01/26/95	01/26/95	01/26/95	01/24/95	01/24/95	01/24/95	01/24/95	01/24/95	01/23/95
Total Petroleum Hydrocarbons (mg/L)	1.0 **	<u>1.1</u>	<u>3.37</u>	<u>1.15</u>	<u>1.31</u>	<u>14.1</u>	<u>10.7</u>	<u>3.08</u>	<u>21</u>	<u>27</u>	<u>27.8</u>
Volatile Organic Compounds (ug/L)											
1,1,1-Trichloroethane	30	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
1,1,2,2-Tetrachloroethane	2	10UJ	10UJ	10UJ	10UJ	710UJ	200UJ	10UJ	710UJ	17UJ	100
1,1,2-Trichloroethane	3	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
1,1-Dichloroethane	70	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
1,1-Dichloroethene	2	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
1,2-Dibromoethane	--	20U	20U	20U	20U	1400U	400U	20UJ	1400U	33U	2000U
1,2-Dichloroethane	2	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
1,2-Dichloroethene(Total)	110	10U	10U	10U	10U	710U	200U	10U	<u>1100</u>	17U	100
1,2-Dichloropropane	1	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
1-Butanol	--	500U	500U	500U	500U	36000UJ	100	500U	36000UJ	840UJ	500U
2-Butanol	--	500U	500U	500U	500U	26000J	42000J	500U	36000UJ	840UJ	500U
2-Butanone	300	10UJ	10UJ	10UJ	10UJ	<u>2800J</u>	<u>3000J</u>	10UJ	710UJ	17UJ	100
2-Hexanone	100 **	10UJ	10UJ	10UJ	10UJ	710UJ	200UJ	10UJ	710UJ	17UJ	100
2-Methyl-2-propanol	500 **	500U	500U	500U	500U	36000UJ	100	500U	36000UJ	840UJ	500U
2-Propanol	--	500U	500U	500U	500U	36000UJ	7000J	500U	36000UJ	840UJ	500U
4-Methyl-2-pentanone	400	10U	10U	10U	10U	710U	200U	10UJ	710U	17U	100
Acetone	700	10UJ	10UJ	10UJ	10UJ	710UJ	480J	10UJ	710UJ	17UJ	100
Benzene	1	10U	<u>13</u>	10U	10U	710U	200U	10U	<u>710</u>	<u>170</u>	100
Bromodichloromethane	1	<u>2J</u>	10U	10U	10U	710U	200U	<u>10</u>	710U	17U	100
Bromoform	4	10U	10UJ	10U	10U	710U	200U	10U	710U	17UJ	100
Bromomethane	10	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Carbon disulfide	--	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Carbon tetrachloride	2	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Chlorobenzene	4	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Chloroethane	100 **	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Chloroform	6	<u>16</u>	2J	<u>12</u>	<u>16J</u>	710U	200U	<u>40</u>	710U	17U	100
Chloromethane	30	10UJ	10U	10UJ	10UJ	710U	200U	10U	710U	17U	100
cis-1,3-Dichloropropene	0.02	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Dibromochloromethane	10	10U	10U	10U	10U	710U	200U	10U	710U	17U	100

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW22D Date: 01/27/95	GMMW23I 01/26/95	GMMW23D 01/26/95	GMMW23DFR 01/26/95	GMMW24I 01/24/95	GMMW24IFR 01/24/95	GMMW24D 01/24/95	MW8 01/24/95	MW9 01/24/95	MW10 01/23/95
Ethylbenzene	700	10U	3J	10U	1J	710U	200U	10U	710U	17U	<u>12000</u>
Hexane	--	20U	9J	20U	20U	1400U	400U	20UJ	1400U	33UJ	2000U
Methyl-t-butyl ether	700 **	20U	20U	20U	20U	1400UJ	400UJ	20UJ	1400UJ	33U	2000U
Methylene chloride	2	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
n-Propylbenzene	--	20U	14J	5J	20U	1400U	400U	20U	1400U	33U	2000U
Styrene	100	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Tetrachloroethene	1	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Toluene	100	10U	1J	10U	10U	710U	200U	10U	510J	17U	100
trans-1,3-Dichloropropene	0.02	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Trichloroethene	1	10U	10U	10U	10U	710U	200U	10U	710U	17U	100
Vinyl chloride	5	10U	10U	10UJ	10U	710U	200U	10U	<u>3700</u>	17U	100
Xylenes (Total)	40	10U	4J	10U	10U	710U	22J	10U	<u>2300</u>	17U	<u>38000</u>
Total VOCs		18	46	17	34	28800	52502	50	18220	170	500

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: PKMW-4 Date: 01/27/95	GTFIRMB9 DP10 10/21/94	LOS86 DP10 10/25/94	LOS815 DP08 10/24/94	LOS818 DP09 10/24/94	MBSB4 DP16 11/02/94	MBSB4FR DP16 11/02/94	N2TFSB2 DP12 11/08/94	N2TFSB3 DP10 11/08/94
Total Petroleum Hydrocarbons (mg/L)	1.0 **	25.3	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (ug/L)										
1,1,1-Trichloroethane	30	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
1,1,2,2-Tetrachloroethane	2	10UJ	10U	10U	25U	10U	10U	10U	25UJ	10U
1,1,2-Trichloroethane	3	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
1,1-Dichloroethane	70	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
1,1-Dichloroethene	2	10U	10U	10U	25U	10U	10U	10U	25UJ	10UJ
1,2-Dibromoethane	--	20U	20U	20U	50U	20U	20U	20U	50UJ	20U
1,2-Dichloroethane	2	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
1,2-Dichloroethene(Total)	110	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
1,2-Dichloropropane	1	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
1-Butanol	--	500U	500U	500U	1200UJ	500U	500U	500U	1200UJ	500U
2-Butanol	--	500U	500U	500U	1200U	500U	500U	500U	1200UJ	500U
2-Butanone	300	10UJ	10UJ	10UJ	25UJ	10UJ	10UJ	10UJ	25UJ	10UJ
2-Hexanone	100 **	10UJ	10UJ	10UJ	25UJ	10UJ	10UJ	10UJ	25UJ	10UJ
2-Methyl-2-propanol	500 **	500U	500U	500U	1200U	500U	500U	500U	1200UJ	500U
2-Propanol	--	500U	500U	500U	1200UJ	500U	500U	500U	1200UJ	500U
4-Methyl-2-pentanone	400	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Acetone	700	140J	10UJ	10UJ	25UJ	10UJ	18UJ	18UJ	25UJ	10UJ
Benzene	1	10U	10U	10U	11J	10U	2J	2J	25UJ	10U
Bromodichloromethane	1	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Bromoform	4	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Bromomethane	10	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Carbon disulfide	--	10U	10U	10U	25U	10U	10U	10U	25UJ	10UJ
Carbon tetrachloride	2	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Chlorobenzene	4	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Chloroethane	100 **	10U	10UJ	10UJ	25UJ	10UJ	10U	10U	25UJ	10UJ
Chloroform	8	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Chloromethane	30	10UJ	10UJ	10UJ	25UJ	10UJ	10U	10U	25UJ	10U
cis-1,3-Dichloropropene	0.02	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Dibromochloromethane	10	10U	10U	10U	25U	10U	10U	10U	25UJ	10U

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP *	Sample ID: PKMW-4	GTFIRMB9	LOSB6	LOSB15	LOSB18	MBSB4	MBSB4FR	N2TFSB2	N2TFSB3
	Groundwater		DP10	DP10	DP08	DP09	DP16	DP16	DP12	DP10
	Quality Standard (Higher of PQLs)	Date: 01/27/95	10/21/94	10/25/94	10/24/94	10/24/94	11/02/94	11/02/94	11/08/94	11/08/94
Ethylbenzene	700	10U	10U	10U	25U	10U	10U	10U	25UJ	4J
Hexane	-	20U	20UJ	20UJ	50UJ	20UJ	20UJ	20UJ	4700J	77J
Methyl-t-butyl ether	700 **	260	20U	20U	50U	20U	20U	20U	50UJ	20U
Methylene chloride	2	10U	10U	10U	25U	10U	<u>69</u>	<u>68</u>	25UJ	10U
n-Propylbenzene	-	20U	20U	20U	110	20U	20U	20U	2800J	24
Styrene	100	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Tetrachloroethene	1	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Toluene	100	10U	10U	10U	25U	2J	10U	10U	25UJ	10U
trans-1,3-Dichloropropene	0.02	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Trichloroethene	1	10U	10U	10U	25U	10U	10U	10U	25UJ	10U
Vinyl chloride	5	10U	10UJ	10UJ	25UJ	10UJ	10U	10U	25UJ	10U
Xylenes (Total)	40	10U	10U	10U	25U	4J	10U	10U	25UJ	3J
Total VOCs		400	0	0	121	8	71	70	7500	108

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte.	NJDEP *	Sample ID: N3TFSB4	N3TFSB5	N3TFSB6	PESTSB1	PSSB1	PSSB1-FR	STFSB3	FBA1-110294
	Groundwater	DP10	DP09	DP12	DP10	DP10	DP10	DP10	
	Quality Standard (Higher of PQLs)	Date: 10/17/94	10/19/94	11/02/94	11/08/94	11/08/94	11/08/94	11/08/94	11/02/94
Total Petroleum Hydrocarbons (mg/L)	1.0 **	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (ug/L)									
1,1,1-Trichloroethane	30	250U	560UJ	170U	25U	20U	10U	20U	10U
1,1,2,2-Tetrachloroethane	2	250U	560UJ	170U	25U	20U	10U	20U	10U
1,1,2-Trichloroethane	3	250U	560UJ	170U	25U	20U	10U	20U	10U
1,1-Dichloroethane	70	250U	560UJ	170U	25U	20U	10U	20U	10U
1,1-Dichloroethene	2	250U	560UJ	170U	25U	20U	10UJ	20U	10U
1,2-Dibromoethane	--	500	1100	330U	50U	40U	20U	40U	20U
1,2-Dichloroethane	2	250U	560UJ	170U	25U	20U	10U	20U	10U
1,2-Dichloroethene(Total)	110	250U	560UJ	170U	25U	20U	10U	20U	10U
1,2-Dichloropropane	1	250U	560UJ	170U	25U	20U	10U	20U	10U
1-Butanol	--	12000U	28000UJ	8300U	1200UJ	100	500U	100	500U
2-Butanol	--	12000U	28000UJ	8300U	1200U	100	500U	100	500U
2-Butanone	300	250UJ	560UJ	170UJ	25U	20U	10UJ	20U	10U
2-Hexanone	100 **	250UJ	560UJ	170UJ	25U	20U	10UJ	20U	10U
2-Methyl-2-propanol	500 **	12000U	28000UJ	8300U	1200UJ	100	500U	100	500U
2-Propanol	--	12000U	28000UJ	8300U	1200U	100	500U	100	500U
4-Methyl-2-pentanone	400	250U	560UJ	170U	25UJ	20UJ	10U	20UJ	10U
Acetone	700	250UJ	560UJ	240UJ	45U	55U	24UJ	38U	6J
Benzene	1	<u>170J</u>	560UJ	<u>28J</u>	<u>140</u>	<u>5J</u>	<u>7J</u>	20U	10U
Bromodichloromethane	1	250U	560UJ	170U	25U	20U	10U	20U	10U
Bromoform	4	250U	560UJ	170U	25U	20U	10U	20U	10U
Bromomethane	10	250U	560UJ	170U	25U	20U	10U	20U	10U
Carbon disulfide	--	250UJ	560UJ	170U	25U	20U	10UJ	20U	10U
Carbon tetrachloride	2	250U	560UJ	170U	25U	20U	10U	20U	10U
Chlorobenzene	4	<u>14000</u>	<u>1100J</u>	<u>270</u>	<u>200</u>	20U	10U	20U	10U
Chloroethane	100 **	250U	560UJ	170U	25U	20U	10UJ	20U	10U
Chloroform	6	250U	560UJ	170U	25U	20U	10U	20U	10U
Chloromethane	30	250U	560UJ	170U	25UJ	20UJ	10U	20UJ	10U
cis-1,3-Dichloropropene	0.02	250U	560UJ	170U	25U	20U	10U	20U	10U
Dibromochloromethane	10	250U	560UJ	170U	25U	20U	10U	20U	10U

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP *	Sample ID: N3TFSB4	N3TFSB5	N3TFSB6	PESTSB1	PSSB1	PSSB1-FR	STFSB3	FBA1-110294
	Groundwater	DP10	DP09	DP12	DP10	DP10	DP10	DP10	
	Quality Standard (Higher of PQLs)	Date: 10/17/94	10/19/94	11/02/94	11/08/94	11/08/94	11/08/94	11/08/94	11/02/94
Ethylbenzene	700	250U	560UJ	170U	410	20U	3J	20U	10U
Hexane	~	500	4800J	1800J	130	230	280J	340	20U
Methyl-t-butyl ether	700 **	500	1100UJ	330U	520J	40U	20U	40U	20U
Methylene chloride	2	250U	560UJ	170U	25U	20U	10U	20U	2J
n-Propylbenzene	~	500	2000J	420	180J	110J	130	29J	20U
Styrene	100	250U	560UJ	170U	25U	20U	10U	20U	10U
Tetrachloroethene	1	250U	560UJ	170U	25U	20U	10U	20U	10U
Toluene	100	250U	560UJ	170U	17J	20U	1J	20U	10U
trans-1,3-Dichloropropene	0.02	250U	560UJ	170U	25U	20U	10U	20U	10U
Trichloroethene	1	250U	560UJ	170U	25U	20U	10U	20U	10U
Vinyl chloride	5	250U	560UJ	170U	25U	20U	10U	20U	10U
Xylenes (Total)	40	250U	560UJ	170U	<u>330</u>	3J	8J	20U	10U
Total VOCs		14170	7700	2518	1927	348	499	369	8

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

	NJDEP *	Sample ID: FBA2-110894	FBA1-012395	FBA2-012495	FBA3-012595	FBA4-012695	FBA5-012795
	Groundwater						
Analyte	Quality Standard (Higher of PQLs)	Date: 11/08/94	01/23/95	01/24/95	01/25/95	01/26/95	01/27/95
Total Petroleum Hydrocarbons (mg/L)	1.0 **	NA	0.25U	0.25U	0.25U	0.25U	0.25U
Volatile Organic Compounds (ug/L)							
1,1,1-Trichloroethane	30	10U	10U	10U	10U	10U	10U
1,1,2,2-Tetrachloroethane	2	10U	10U	10U	10U	10U	10U
1,1,2-Trichloroethane	3	10U	10U	10U	10U	10U	10U
1,1-Dichloroethane	70	10U	10U	10U	10U	10U	10U
1,1-Dichloroethene	2	10U	10U	10U	10U	10U	10U
1,2-Dibromoethane	--	20U	20U	20U	20U	20U	20U
1,2-Dichloroethane	2	10U	10U	10U	10U	10U	10U
1,2-Dichloroethene(Total)	110	10U	10U	10U	10U	10U	10U
1,2-Dichloropropane	1	10U	10U	10U	10U	10U	10U
1-Butanol	--	500U	500U	500U	500U	500U	500U
2-Butanol	--	500U	500U	500U	500U	500U	500U
2-Butanone	300	10U	10U	10U	10U	10U	10U
2-Hexanone	100 **	10U	10U	10U	10U	10U	10U
2-Methyl-2-propanol	500 **	500U	500U	500U	500U	500U	500U
2-Propanol	--	500U	500U	500U	500U	500U	500U
4-Methyl-2-pentanone	400	10U	10U	10U	10U	10U	10U
Acetone	700	8J	10U	10U	10U	10U	10U
Benzene	1	10U	10U	10U	10U	10U	10U
Bromodichloromethane	1	10U	10U	10U	10U	10U	10U
Bromoform	4	10U	10U	10U	10U	10U	10U
Bromomethane	10	10U	10U	10U	10U	10U	10U
Carbon disulfide	--	10U	10U	10U	10U	10U	10U
Carbon tetrachloride	2	10U	10U	10U	10U	10U	10U
Chlorobenzene	4	10U	10U	10U	18	10U	2J
Chloroethane	100 **	10U	10U	10U	10U	10U	10U
Chloroform	6	10U	10U	10U	10U	10U	10U
Chloromethane	30	10U	10U	10U	10U	10U	10U
cis-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U
Dibromochloromethane	10	10U	10U	10U	10U	10U	10U

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: FBA2-110894	FBA1-012395	FBA2-012495	FBA3-012595	FBA4-012695	FBA5-012795
		Date: 11/08/94	01/23/95	01/24/95	01/25/95	01/26/95	01/27/95
Ethylbenzene	700	10U	10U	10U	10U	10U	10U
Hexane	--	20U	20U	20U	20U	20U	20U
Methyl-t-butyl ether	700 **	20U	20U	20U	20U	20U	20U
Methylene chloride	2	2J	1J	1J	2J	1J	1J
n-Propylbenzene	--	20U	20U	20U	20U	20U	20U
Styrene	100	10U	10U	10U	10U	10U	10U
Tetrachloroethane	1	10U	10U	10U	10U	10U	10U
Toluene	100	10U	10U	10U	10U	10U	10U
trans-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U
Trichloroethene	1	10U	10U	10U	10U	10U	10U
Vinyl chloride	5	10U	10U	10U	10U	10U	10U
Xylenes (Total)	40	10U	10U	10U	10U	10U	10U
Total VOCs		10	1	1	20	1	3

See last page for footnotes.



Table S-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: TB-101994 Date: 10/19/94	TB-102094 10/20/94	TB-102194 10/21/94	TB-102594 10/24/94	TB-110294 11/02/94	TB-110894 11/08/94	TB1-012395 01/23/95
Total Petroleum Hydrocarbons (mg/L)	1.0 **	NA	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds (ug/L)								
1,1,1-Trichloroethane	30	10U	10U	10U	10U	10U	10U	10U
1,1,2,2-Tetrachloroethane	2	10U	10U	10U	10U	10U	10U	10U
1,1,2-Trichloroethane	3	10U	10U	10U	10U	10U	10U	10U
1,1-Dichloroethane	70	10U	10U	10U	10U	10U	10U	10U
1,1-Dichloroethane	2	10U	10U	10U	10U	10U	10U	10U
1,2-Dibromoethane	--	20U	20U	20U	20U	20U	20U	20U
1,2-Dichloroethane	2	10U	10U	10U	10U	10U	10U	10U
1,2-Dichloroethane(Total)	110	10U	10U	10U	10U	10U	10U	10U
1,2-Dichloropropane	1	10U	10U	10U	10U	10U	10U	10U
1-Butanol	--	500U	500U	500U	500U	500U	500U	500U
2-Butanol	--	500U	500U	500U	500U	500U	500U	500U
2-Butanone	300	10U	10U	10U	10U	10U	10U	10U
2-Hexanone	100 **	10U	10U	10U	10U	10U	10U	10U
2-Methyl-2-propanol	500 **	500U	500U	500U	500U	500U	500U	500U
2-Propanol	--	500U	500U	500U	500U	500U	500U	500U
4-Methyl-2-pentanone	400	10U	10U	10U	10U	10U	10U	10U
Acetone	700	10U	10U	10U	10U	7J	7J	10U
Benzene	1	10U	10U	10U	10U	10U	10U	10U
Bromodichloromethane	1	10U	10U	10U	10U	10U	10U	10U
Bromoform	4	10U	10U	10U	10U	10U	10U	10U
Bromomethane	10	10U	10U	10U	10U	10U	10U	10U
Carbon disulfide	--	10U	10U	10U	10U	10U	10U	10U
Carbon tetrachloride	2	10U	10U	10U	10U	10U	10U	10U
Chlorobenzene	4	10U	10U	10U	10U	10U	10U	10U
Chloroethane	100 **	10U	10U	10U	10U	10U	10U	10U
Chloroform	6	10U	10U	10U	10U	10U	10U	10U
Chloromethane	30	10U	10U	10U	10U	10U	10U	10U
cis-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U	10U
Dibromochloromethane	10	10U	10U	10U	10U	10U	10U	10U

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: TB-101994 Date: 10/19/94	TB-102094 10/20/94	TB-102194 10/21/94	TB-102594 10/24/94	TB-110294 11/02/94	TB-110894 11/08/94	TB1-012395 01/23/95
Ethylbenzene	700	10U	10U	10U	10U	10U	10U	10U
Hexane	--	20U	20U	20U	20U	20U	20U	20U
Methyl-t-butyl ether	700 **	20U	20U	20U	20U	20U	20U	20U
Methylene chloride	2	2J	5J	10U	10U	2J	3J	10U
n-Propylbenzene	--	20U	20U	20U	20U	20U	20U	20U
Styrene	100	10U	10U	10U	10U	10U	10U	10U
Tetrachloroethene	1	10U	10U	10U	10U	10U	10U	10U
Toluene	100	10U	10U	10U	10U	10U	10U	10U
trans-1,3-Dichloropropene	0.02	10U	10U	10U	10U	10U	10U	10U
Trichloroethene	1	10U	10U	10U	10U	10U	10U	10U
Vinyl chloride	5	10U	10U	10U	10U	10U	10U	10U
Xylenes (Total)	40	10U	10U	10U	10U	10U	10U	10U
Total VOCs		2	5	0	0	9	10	0



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP *	Sample ID: TB2-012495	TB3-012595	TB4-012695	TB5-012795
	Groundwater Quality Standard (Higher of PQLs)	Date: 01/24/95	01/25/95	01/26/95	01/27/95
Total Petroleum Hydrocarbons (mg/L)	1.0 **	NA	NA	NA	NA
Volatile Organic Compounds (ug/L)					
1,1,1-Trichloroethane	30	10U	10U	10U	10U
1,1,2,2-Tetrachloroethane	2	10U	10U	10U	10U
1,1,2-Trichloroethane	3	10U	10U	10U	10U
1,1-Dichloroethane	70	10U	10U	10U	10U
1,1-Dichloroethene	2	10U	10U	10U	10U
1,2-Dibromoethane	--	20U	20U	20U	20U
1,2-Dichloroethane	2	10U	10U	10U	10U
1,2-Dichloroethene(Total)	110	10U	10U	10U	10U
1,2-Dichloropropane	1	10U	10U	10U	10U
1-Butanol	--	500U	500U	500U	500U
2-Butanol	--	500U	500U	500U	500U
2-Butanone	300	10U	10U	10U	10U
2-Hexanone	100 **	10U	10U	10U	10U
2-Methyl-2-propanol	500 **	500U	500U	500U	500U
2-Propanol	--	500U	500U	500U	500U
4-Methyl-2-pentanone	400	10U	10U	10U	10U
Acetone	700	10U	10U	10U	10U
Benzene	1	10U	10U	10U	10U
Bromodichloromethane	1	10U	10U	10U	10U
Bromoform	4	10U	10U	10U	10U
Bromomethane	10	10U	10U	10U	10U
Carbon disulfide	--	10U	10U	10U	10U
Carbon tetrachloride	2	10U	10U	10U	10U
Chlorobenzene	4	10U	6U	10U	1U
Chloroethane	100 **	10U	10U	10U	10U
Chloroform	8	10U	10U	10U	10U
Chloromethane	30	10U	10U	10U	10U
cis-1,3-Dichloropropene	0.02	10U	10U	10U	10U
Dibromochloromethane	10	10U	10U	10U	10U

See last page for footnotes.



Table 5-11. Total Petroleum Hydrocarbons and Volatile Organic Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte	NJDEP *	Sample ID: TB2-012495	TB3-012595	TB4-012695	TB5-012795
	Groundwater Quality Standard (Higher of PQLs)	Date: 01/24/95	01/25/95	01/26/95	01/27/95
Ethylbenzene	700	10U	10U	10U	10U
Hexane	--	20U	20U	20U	20U
Methyl-t-butyl ether	700 **	20U	20U	20U	20U
Methylene chloride	2	10U	2J	2J	1J
n-Propylbenzene	--	20U	20U	20U	20U
Styrene	100	10U	10U	10U	10U
Tetrachloroethene	1	10U	10U	10U	10U
Toluene	100	10U	10U	10U	10U
trans-1,3-Dichloropropene	0.02	10U	10U	10U	10U
Trichloroethene	1	10U	10U	10U	10U
Vinyl chloride	5	10U	10U	10U	10U
Xylenes (Total)	40	10U	10U	10U	10U
Total VOCs		0	8	2	2

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per liter (ug/L) (equivalent to parts per billion (ppb)) except total petroleum hydrocarbon (TPH) results and criteria, which are reported in milligrams per liter (mg/L) (equivalent to parts per million (ppm)).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols contained in the Statement of Work (SOW) OLM01.8, and New Jersey modified 418.1 for total petroleum hydrocarbons (TPH).

Exceedances of NJDEP criteria are shown in bold and are underlined.

VOCs Volatile organic compounds.

FBA Indicates a field blank associated with aqueous samples.

PQL Practical quantitation level.

FR Field replicate of previous sample.

TB Trip blank.

U The compound was analyzed for, but not detected at the specific detection limit.

J Estimated result.

-- No applicable criteria.

N Presumptive evidence.

NA Not analyzed.

* NJDEP Groundwater Standards, New Jersey Register, April 5, 1993.

** Interim generic groundwater quality criterion.



Table 5-12. Semivolatile Organic Compounds in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: EB1 EB29 EB51 EB68 EBR13 EBR19 GMMW2 GMMW3 GMMW4 GMMW6 GMMW8										
		Date: 01/26/95	01/26/95	01/25/95	01/24/95	01/27/95	01/24/95	01/25/95	01/25/95	01/25/95	01/25/95	01/23/95
1,2,4-Trichlorobenzene	9	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
1,2-Dichlorobenzene	600	10U	10U	10U	10U	10U	10U	19J	9J	10U	10U	10U
1,3-Dichlorobenzene	600	10U	10U	10U	10U	10U	10U	30U	18	10U	10U	10U
1,4-Dichlorobenzene	75	10U	10U	10U	10U	10U	10U	3J	130	10U	10U	10U
2,2'-oxybis(1-chloropropane)	300	10U	10U	10UJ	10UJ	10U	10UJ	30U	10UJ	10UJ	10UJ	10UJ
2,4,5-Trichlorophenol	700	25U	25U	25U	25U	25U	25U	75U	25U	25U	25U	25U
2,4,6-Trichlorophenol	20	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
2,4-Dichlorophenol	20	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
2,4-Dimethylphenol	100	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
2,4-Dinitrophenol	40	25U	25U	25U	25U	25U	25U	75UJ	25U	25U	25U	25UJ
2,4-Dinitrotoluene	10	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
2,6-Dinitrotoluene	10	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
2-Chloronaphthalene	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
2-Chlorophenol	40	10U	10U	10U	10U	10U	10U	30U	17	10U	10U	10U
2-Methylnaphthalene	100 **	10U	10U	10U	10U	3J	10U	150	12	1J	2J	10U
2-Methylphenol	400 **	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
2-Nitroaniline	--	25U	25U	25U	25U	25U	25U	75UJ	25U	25U	25U	25U
2-Nitrophenol	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
3,3'-Dichlorobenzidine	60	10U	10U	10U	10UJ	10U	10UJ	30U	10U	10U	10U	10UJ
3-Nitroaniline	--	25U	25U	25U	25U	25U	25U	75U	25U	25U	25U	25U
4,6-Dinitro-2-methylphenol	--	25U	25U	25U	25U	25U	25U	75U	25U	25U	25U	25U
4-Bromophenyl phenyl ether	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
4-Chloro-3-methylphenol	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
4-Chloroaniline	--	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	30UJ	10UJ	10UJ	10UJ	10UJ
4-Chlorophenyl phenyl ether	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
4-Methylphenol	350 **	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	2J
4-Nitroaniline	--	25U	25U	25U	25U	25U	25U	75U	25U	25U	25U	25U
4-Nitrophenol	--	25U	25U	25U	25U	25U	25U	75UJ	25U	25U	25U	25UJ
Acenaphthene	400	10U	10U	10U	3J	1J	1J	30U	2J	7J	10U	10U
Acenaphthylene	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Anthracene	2000	10U	10U	10U	10U	10U	10U	30U	10U	2J	2J	10U
Benzo(a)anthracene	--	2J	10U	10U	10U	10U	10U	30U	1J	2J	5J	10U
Benzo(a)pyrene	--	2J	10U	10U	10U	10U	10U	30U	10U	1J	5J	10U
Benzo(b)fluoranthene	--	2J	10U	10U	10U	10U	1J	30U	10U	1J	8J	10U
Benzo(g,h,i)perylene	--	2J	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Benzo(k)fluoranthene	--	2J	10U	10U	10U	10U	1J	30U	10U	1J	9J	10U

See last page for footnotes.



Table 5-12. Semivolatile Organic Compounds in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: EB1 EB29 EB51 EB88 EBR13 EBR19 GMMW2 GMMW3 GMMW4 GMMW6 GMMW8										
		Date: 01/26/95	01/26/95	01/25/95	01/24/95	01/27/95	01/24/95	01/25/95	01/25/95	01/25/95	01/25/95	01/23/95
Butyl benzyl phthalate	100	10U	10U	10UJ	10UJ	10U	10UJ	30UJ	10UJ	10UJ	10UJ	10UJ
Carbazole	--	10U	10U	10U	10U	2J	10U	30U	10U	10U	10U	10U
Chrysene	--	3J	10U	10U	10U	10U	1J	30U	2J	3J	4J	10U
Di-n-butyl phthalate	900	10U	10U	10U	1J	10U	10U	30U	10U	10U	10U	10U
Di-n-octyl phthalate	100	10U	10U	10UJ	10UJ	10U	10UJ	30U	10UJ	10UJ	10UJ	10UJ
Dibenz(a,h)anthracene	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Dibenzofuran	100 **	10U	10U	10U	10U	2J	10U	4J	10U	2J	10U	10U
Diethyl phthalate	5000	10U	10U	10U	10U	10U	10U	30U	10U	1J	10U	10U
Dimethyl phthalate	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Fluoranthene	300	10U	10U	10U	1J	10U	2J	30U	10U	3J	6J	10U
Fluorene	300	10U	10U	2J	10U	1J	10U	11J	2J	3J	10U	10U
Hexachlorobenzene	10	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Hexachlorobutadiene	1	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Hexachlorocyclopentadiene	50	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Hexachloroethene	10	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	--	1J	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Isophorone	100	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
N-Nitroso-di-n-propylamine	20	10U	10UJ	10U	10U	10UJ	10U	30U	10U	10U	10U	10U
N-Nitrosodiphenylamine(1)	20	10UJ	10UJ	10UJ	10U	10UJ	10U	30U	10UJ	10UJ	10UJ	10U
Naphthalene	30 **	10U	10U	10U	2J	9J	10U	40	64	3J	2J	10U
Nitrobenzene	10	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Pentachlorophenol	1	25U	25U	25U	25U	25U	25U	75U	25U	25U	25U	25U
Phenanthrene	100 **	10U	10U	10U	10U	1J	1J	30	2J	6J	3J	10U
Phenol	4000	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
Pyrene	200	2J	10U	10U	2J	10U	2J	4J	3J	5J	8J	1J
bis(2-Chloroethoxy)methane	--	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
bis(2-Chloroethyl)ether	10	10U	10U	10U	10U	10U	10U	30U	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	30	3J	3J	4J	4J	1J	2J	6J	4J	2J	6J	10UJ
Total SVOCs		19	3	6	13	20	11	267	266	43	60	3

See last page for footnotes.



Table 5-12. Semivolatile Organic Compound in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW9	GMMW10	GMMW11	GMMW13	GMMW14	GMMW15	GMMW17	GMMW19	GMMW20	GMMW21I
		Date: 01/23/95	01/23/95	01/25/95	01/27/95	01/23/95	01/24/95	01/25/95	01/27/95	01/23/95	01/26/95
1,2,4-Trichlorobenzene	9	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,2-Dichlorobenzene	600	10U	10U	10U	10U	10U	10U	1J	10U	10U	3J
1,3-Dichlorobenzene	600	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,4-Dichlorobenzene	75	10U	10U	10U	10U	10U	10U	2J	10U	10U	4J
2,2'-oxybis(1-chloropropane)	300	10UJ	10U	10UJ	10U	10UJ	10UJ	10UJ	10U	10UJ	10UJ
2,4,5-Trichlorophenol	700	25U	25U	25U	25U	25U	25U	25U	25U	25U	25U
2,4,6-Trichlorophenol	20	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
2,4-Dichlorophenol	20	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
2,4-Dimethylphenol	100*	10U	10U	1J	10U	10U	10U	10U	10U	10U	10U
2,4-Dinitrophenol	40	25U	25UJ	25U	25U	25U	25UJ	25U	25U	25U	25U
2,4-Dinitrotoluene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
2,6-Dinitrotoluene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Chloronaphthalene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Chlorophenol	40	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Methylnaphthalene	100 **	10U	10U	10U	10U	10U	10U	5J	2J	10U	10U
2-Methylphenol	400 **	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Nitroaniline	--	25U	25UJ	25U	25U	25U	25U	25U	25U	25U	25U
2-Nitrophenol	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
3,3'-Dichlorobenzidine	60	10UJ	10U	10U	10U	10UJ	10UJ	10UJ	10U	10UJ	10U
3-Nitroaniline	--	25U	25U	25U	25U	25U	25U	25U	25U	25U	25U
4,6-Dinitro-2-methylphenol	--	25U	25U	25U	25U	25U	25U	25U	25U	25U	25U
4-Bromophenyl phenyl ether	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
4-Chloro-3-methylphenol	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
4-Chloroaniline	--	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ
4-Chlorophenyl phenyl ether	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
4-Methylphenol	350 **	2J	10U	10U	10U	10U	10U	10U	10U	2J	2J
4-Nitroaniline	--	25U	25U	25U	25U	25U	25U	25U	25U	25U	25U
4-Nitrophenol	--	25U	25UJ	25U	25U	25U	25UJ	25U	25U	25U	25U
Acenaphthene	400	10U	10U	15	10U	2J	10U	10U	10U	10U	10U
Acenaphthylene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Anthracene	2000	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Benzo(a)anthracene	--	10U	10U	10U	2J	10U	10U	10U	10U	2J	10U
Benzo(a)pyrene	--	10U	10U	10U	2J	10U	10U	10U	10U	1J	10U
Benzo(b)fluoranthene	--	10U	10U	10U	2J	10U	1J	10U	10U	1J	10U
Benzo(g,h,i)perylene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Benzo(k)fluoranthene	--	10U	10U	10U	2J	10U	1J	10U	10U	1J	10U

See last page for footnotes.



Table 5-12. Semivolatile Organic Compound in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW9 GMMW10 GMMW11 GMMW13 GMMW14 GMMW15 GMMW17 GMMW19 GMMW20 GMMW21I									
		Date: 01/23/95	01/23/95	01/25/95	01/27/95	01/23/95	01/24/95	01/25/95	01/27/95	01/23/95	01/26/95
Butyl benzyl phthalate	100	10UJ	10UJ	10UJ	10U	10UJ	10UJ	10UJ	10U	10UJ	10UJ
Carbazole	--	10U	10U	3J	10U	10U	10U	10U	10U	10U	10U
Chrysene	--	10U	10U	10U	3J	1J	1J	10U	10U	2J	10U
Di-n-butyl phthalate	900	10U	10U	2J	10U	10U	10U	10U	10U	10U	10U
Di-n-octyl phthalate	100*	10UJ	10U	10UJ	10U	10UJ	10UJ	10UJ	10U	10UJ	10UJ
Dibenz(a,h)anthracene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Dibenzofuran	100 **	10U	10U	9J	10U	10U	10U	10U	10U	10U	10U
Diethyl phthalate	5000	10U	10U	1J	10U	10U	10U	10U	10U	10U	1J
Dimethyl phthalate	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Fluoranthene	300	10U	10U	3J	2J	10U	2J	10U	10U	1J	10U
Fluorene	300	10U	10U	6J	10U	2J	10U	10U	2J	10U	10U
Hexachlorobenzene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Hexachlorobutadiene	1	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Hexachlorocyclopentadiene	50	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Hexachloroethane	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Isophorone	100	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
N-Nitroso-di-n-propylamine	20	10U	10U	10U	10UJ	10U	10U	10U	10UJ	10U	10U
N-Nitrosodiphenylamine(1)	20	10U	10U	10UJ	10UJ	10U	10U	10U	10UJ	10U	10UJ
Naphthalene	30 **	10U	10U	10U	10U	16	10U	5J	10U	1J	10U
Nitrobenzene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Pentachlorophenol	1	25U	25U	25U	25U	25U	25U	25U	25U	25U	3J
Phenanthrene	100 **	10U	10U	1J	10U	1J	2J	10U	10U	2J	10U
Phenol	4000	10U	10U	10U	10U	2J	10U	2J	10U	10U	12
Pyrene	200	10U	10U	3J	3J	1J	2J	10U	10U	2J	10U
bis(2-Chloroethoxy)methane	--	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
bis(2-Chloroethyl)ether	10	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	30	10UJ	10U	9J	3J	10UJ	8J	3J	2J	3J	6J
Total SVOCs		2	0	53	19	25	17	18	8	18	31

See last page for footnotes.



Table 5-12. Semivolatile Organic Compound in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW21D	GMMW22D	GMMW23I	GMMW23D	GMMW23DFR	GMMW24I	GMMW24IFR	GMMW24D
		Date: 01/24/95	01/27/95	01/26/95	01/26/95	01/26/95	01/24/95	01/24/95	01/24/95
1,2,4-Trichlorobenzene	9	10U	10U	100U	10U	10U	10U	10U	10U
1,2-Dichlorobenzene	600	10U	10U	100U	10U	10U	10U	3J	10U
1,3-Dichlorobenzene	600	10U	10U	100U	10U	10U	10U	10U	10U
1,4-Dichlorobenzene	75	10U	10U	100U	10U	10U	10U	10U	10U
2,2'-oxybis(1-chloropropane)	300	10UJ	10U	100U	10UJ	10UJ	10UJ	10UJ	10UJ
2,4,5-Trichlorophenol	700	R	25U	250U	25U	25U	25U	25U	25U
2,4,6-Trichlorophenol	20	R	10U	100U	10U	10U	10U	10U	10U
2,4-Dichlorophenol	20	R	10U	100U	10U	10U	10U	10U	10U
2,4-Dimethylphenol	100*	R	10U	100U	10U	10U	10U	10U	10U
2,4-Dinitrophenol	40	R	25U	250U	25U	25U	25U	25U	25U
2,4-Dinitrotoluene	10	10U	10U	100U	10U	10U	10U	10U	10U
2,6-Dinitrotoluene	10	10U	10U	100U	10U	10U	10U	10U	10U
2-Chloronaphthalene	--	10U	10U	100U	10U	10U	10U	10U	10U
2-Chlorophenol	40	R	10U	100U	10U	10U	10U	10U	10U
2-Methylnaphthalene	100 **	10U	10U	100U	10U	10U	13	9J	10U
2-Methylphenol	400 **	R	10U	100U	5J	8J	2J	2J	10U
2-Nitroaniline	--	25U	25U	250U	25U	25U	25U	25U	25U
2-Nitrophenol	--	R	10U	100U	10U	10U	10U	10U	10U
3,3'-Dichlorobenzidine	60	10U	10U	100U	10U	10U	10UJ	10UJ	10UJ
3-Nitroaniline	--	25U	25U	250U	25U	25U	25U	25U	25U
4,6-Dinitro-2-methylphenol	--	R	25U	250U	25U	25U	25U	25U	25U
4-Bromophenyl phenyl ether	--	10U	10U	100U	10U	10U	10U	10U	10U
4-Chloro-3-methylphenol	--	R	10U	100U	10U	10U	10U	10U	10U
4-Chloroaniline	--	10UJ	10UJ	100UJ	10UJ	10UJ	10UJ	10UJ	10UJ
4-Chlorophenyl phenyl ether	--	10U	10U	100U	10U	10U	10U	10U	10U
4-Methylphenol	350 **	R	15	100U	10U	10U	180	160	10U
4-Nitroaniline	--	25U	25U	250U	25U	25U	25U	25U	25U
4-Nitrophenol	--	R	25U	250U	25U	25U	25U	25U	25U
Acenaphthene	400	10U	10U	100U	10U	10U	10U	10U	10U
Acenaphthylene	--	10U	10U	100U	10U	10U	10U	10U	10U
Anthracene	2000	10U	10U	100U	10U	10U	10U	10U	10U
Benzo(a)anthracene	--	10U	10U	100U	10U	10U	10U	10U	10U
Benzo(a)pyrene	--	10U	10U	100U	10U	10U	10U	10U	10U
Benzo(b)fluoranthene	--	10U	10U	100U	10U	10U	10U	10U	10U
Benzo(g,h,i)perylene	--	10U	10U	100U	10U	10U	10U	10U	10U
Benzo(k)fluoranthene	--	10U	10U	100U	10U	10U	10U	10U	10U

See last page for footnotes.



Table 5-12. Semivolatile Organic Compound in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW21D	GMMW22D	GMMW23I	GMMW23D	GMMW23DFR	GMMW24I	GMMW24IFR	GMMW24D
		Date: 01/24/95	01/27/95	01/28/95	01/26/95	01/28/95	01/24/95	01/24/95	01/24/95
Butyl benzyl phthalate	100	10UJ	10U	100U	10UJ	10UJ	10UJ	10UJ	10UJ
Carbazole	--	10U	10U	100U	10U	10U	10U	10U	10U
Chrysene	--	10U	10U	100U	10U	10U	10U	10U	10U
Di-n-butyl phthalate	900	10U	10U	100U	10UJ	1J	10U	10U	10U
Di-n-octyl phthalate	100*	10UJ	10U	100U	10UJ	10UJ	10UJ	10UJ	10UJ
Dibenz(a,h)anthracene	--	10U	10U	100U	10U	10U	10U	10U	10U
Dibenzofuran	100 **	10U	10U	100U	10U	10U	10U	10U	10U
Diethyl phthalate	5000	10U	1J	100U	10U	10U	10U	10U	10U
Dimethyl phthalate	--	10U	10U	100U	10U	10U	10U	10U	10U
Fluoranthene	300	10U	10U	100U	10U	10U	10U	10U	10U
Fluorene	300	10U	10U	100U	10U	10U	10U	10U	10U
Hexachlorobenzene	10	10U	10U	100U	10U	10U	10U	10U	10U
Hexachlorobutadiene	1	10U	10U	100U	10U	10U	10U	10U	10U
Hexachlorocyclopentadiene	50	10U	10U	100U	10U	10U	10U	10U	10U
Hexachloroethane	10	10U	10U	100U	10U	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	--	10U	10U	100U	10U	10U	10U	10U	10U
Isophorone	100	10U	10U	100U	10U	10U	10U	10U	10U
N-Nitroso-di-n-propylamine	20	10U	10UJ	100U	10U	10U	10U	10U	10U
N-Nitrosodiphenylamine(1)	20	10UJ	10UJ	100UJ	10UJ	10UJ	10U	10U	10U
Naphthalene	30 **	2J	10U	100U	1J	1J	23	17	10U
Nitrobenzene	10	10U	10U	100U	10U	10U	10U	10U	10U
Pentachlorophenol	1	R	25U	250U	25U	25U	25U	9J	25U
Phenanthrene	100 **	10U	10U	100U	10U	10U	10U	10U	10U
Phenol	4000	R	7J	10J	49	48J	21	14	10U
Pyrene	200	10U	10U	100U	10U	10U	10U	10U	10U
bis(2-Chloroethoxy)methane	--	10U	10U	100U	10U	10U	10U	10U	10U
bis(2-Chloroethyl)ether	10	10U	10U	100U	10U	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	30	2J	11	100U	9J	11J	10UJ	12J	9J
Total SVOCs		4	34	10	64	133	239	226	9

See last page for footnotes.



Table 5-12. Semivolatile Organic Compound in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: MW6	MW9	MW10	PKMW-4	FBA1-012395	FBA2-012495	FBA3-012595	FBA4-012695	FBA5-012795
		Date: 01/24/95	01/24/95	01/23/95	01/27/95	01/23/95	01/24/95	01/25/95	01/26/95	01/27/95
1,2,4-Trichlorobenzene	9	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,2-Dichlorobenzene	600	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,3-Dichlorobenzene	600	10U	10U	10U	10U	10U	10U	10U	10U	10U
1,4-Dichlorobenzene	75	10U	10U	10U	10U	10U	10U	10U	10U	10U
2,2'-oxybis(1-chloropropane)	300	10UJ	10UJ	10UJ	10U	10U	10U	10U	10U	10U
2,4,5-Trichlorophenol	700	25U	25U	25U	25U	25U	25U	25U	25U	25U
2,4,6-Trichlorophenol	20	10U	10U	10U	10U	10U	10U	10U	10U	10U
2,4-Dichlorophenol	20	14	10U	10U	10U	10U	10U	10U	10U	10U
2,4-Dimethylphenol	100*	10U	10U	110	10U	10U	10U	10U	10U	10U
2,4-Dinitrophenol	40	25U	25U	25U	25U	25U	25U	25U	25U	25U
2,4-Dinitrotoluene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U
2,6-Dinitrotoluene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Chloronaphthalene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Chlorophenol	40	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Methylnaphthalene	100**	22	8J	310	15	10U	10U	10U	10U	10U
2-Methylphenol	400**	10U	10U	10U	10U	10U	10U	10U	10U	10U
2-Nitroaniline	--	25U	25U	25U	25U	25U	25U	25U	25U	25U
2-Nitrophenol	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
3,3'-Dichlorobenzidine	60	10UJ	10UJ	10UJ	10U	10U	10U	10U	10U	10U
3-Nitroaniline	--	25U	25U	25U	25U	25U	25U	25U	25U	25U
4,6-Dinitro-2-methylphenol	--	25U	25U	25U	25U	25U	25U	25U	25U	25U
4-Bromophenyl phenyl ether	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
4-Chloro-3-methylphenol	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
4-Chloroaniline	--	10UJ	10UJ	10UJ	10UJ	10U	10U	10U	10U	10U
4-Chlorophenyl phenyl ether	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
4-Methylphenol	350**	56	10U	10U	10U	10U	10U	10U	10U	10U
4-Nitroaniline	--	25U	25U	25U	25U	25U	25U	25U	25U	25U
4-Nitrophenol	--	25U	25U	25U	25U	25U	25U	25U	25U	25U
Acenaphthene	400	10U	8J	14	10U	10U	10U	10U	10U	10U
Acenaphthylene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
Anthracene	2000	10U	10U	10U	10U	10U	10U	10U	10U	10U
Benzo(a)anthracene	--	10U	10U	1J	2J	10U	10U	10U	10U	10U
Benzo(a)pyrene	--	10U	10U	10U	2J	10U	10U	10U	10U	10U
Benzo(b)fluoranthene	--	10U	10U	1J	2J	10U	10U	10U	10U	10U
Benzo(g,h,i)perylene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
Benzo(k)fluoranthene	--	10U	10U	1J	2J	10U	10U	10U	10U	10U

See last page for footnotes.



Table 5-12. Semivolatile Organic Compound in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: MW6	MW9	MW10	PKMW-4	FBA1-012395	FBA2-012495	FBA3-012595	FBA4-012695	FBA5-012795
		Date: 01/24/95	01/24/95	01/23/95	01/27/95	01/23/95	01/24/95	01/25/95	01/26/95	01/27/95
Butyl benzyl phthalate	100	10UJ	10UJ	10UJ	10U	10U	10U	10U	10U	10U
Carbazole	--	10U	10U	4J	10U	10U	10U	10U	10U	10U
Chrysene	--	10U	10U	1J	3J	10U	10U	10U	10U	10U
Di-n-butyl phthalate	900	10U	10U	10U	10U	10U	10U	10U	10U	10U
Di-n-octyl phthalate	100*	10UJ	10UJ	10UJ	10U	10U	10U	10U	10U	10U
Dibenz(a,h)anthracene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
Dibenzofuran	100 **	10U	10U	10U	10U	10U	10U	10U	10U	10U
Diethyl phthalate	5000	10U	10U	10U	10U	10U	1J	10U	10U	10U
Dimethyl phthalate	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
Fluoranthene	300	10U	10U	3J	1J	10U	10U	10U	10U	10U
Fluorene	300	10U	13	19	10U	10U	10U	10U	10U	10U
Hexachlorobenzene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U
Hexachlorobutadiene	1	10U	10U	10U	10U	10U	10U	10U	10U	10U
Hexachlorocyclopentadiene	50	10U	10U	10U	10U	10U	10U	10U	10U	10U
Hexachloroethane	10	10U	10U	10U	10U	10U	10U	10U	10U	10U
Indeno(1,2,3-cd)pyrene	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
Isophorone	100	10U	10U	10U	10U	10U	10U	10U	10U	10U
N-Nitroso-di-n-propylamine	20	10U	10U	10U	10UJ	10U	10U	10U	10U	10U
N-Nitrosodiphenylamine(1)	20	10U	10U	10U	10UJ	10U	10U	10U	10U	10U
Naphthalene	30 **	<u>180</u>	10U	<u>73</u>	10U	10U	10U	10U	10U	10U
Nitrobenzene	10	10U	10U	10U	10U	10U	10U	10U	10U	10U
Pentachlorophenol	1	25U	25U	25U	25U	25U	25U	25U	25U	25U
Phenanthrene	100 **	10U	18	32	1J	10U	10U	10U	10U	10U
Phenol	4000	10	15	10U	10U	10U	10U	10U	10U	10U
Pyrene	200	10U	1J	5J	2J	10U	10U	10U	10U	10U
bis(2-Chloroethoxy)methane	--	10U	10U	10U	10U	10U	10U	10U	10U	10U
bis(2-Chloroethyl)ether	10	10U	10U	10U	10U	10U	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	30	10UJ	3J	18J	14	10U	10U	10U	10U	10U
Total SVOCs		282	64	590	44	0	1	0	0	0

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per liter (ug/L) (equivalent to parts per billion [ppb]).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols contained in the Statement of Work (SOW) OLM01.8.

Exceedances of NJDEP criteria are shown in bold and are underlined.

FBA Indicates a field blank associated with aqueous samples.

PQL Practical quantitation level.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specified detection limit.

J Estimated result.

R Rejected result.

-- No applicable criteria.

SVOC Semivolatile organic compound.

* NJDEP Groundwater Standards, New Jersey Register, April 5, 1993.

** Interim generic groundwater quality criterion.



Table 5-13. Pesticides and Polychlorinated Biphenyl Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP* Groundwater Quality Standard (Higher of PQLs)	Sample ID: EB1 EB29 EB51 EB68 EBR13 EBR19 GMMW2 GMMW3 GMMW4 GMMW6 GMMW8										
		Date: 01/26/95	01/26/95	01/25/95	01/24/95	01/27/95	01/24/95	01/25/95	01/25/95	01/25/95	01/25/95	01/23/95
4,4'-DDD	0.1	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
4,4'-DDE	0.1	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
4,4'-DDT	0.1	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
Aldrin	0.04	0.05UJ	0.08U	.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	.05U	.05UJ
Aroclor-1016	0.5	1UJ	1.2U	1U	1UJ	1UJ	1UJ	1UJ	R	1UJ	1U	1UJ
Aroclor-1221	0.5	2UJ	2.4U	2U	2UJ	2UJ	2UJ	2UJ	R	2UJ	2U	2UJ
Aroclor-1232	0.5	1UJ	1.2U	1U	1UJ	1UJ	1UJ	1UJ	R	1UJ	1U	1UJ
Aroclor-1242	0.5	1UJ	1.2U	1U	1UJ	1UJ	1UJ	1UJ	R	1UJ	1U	1UJ
Aroclor-1248	0.5	1UJ	1.2U	1U	1UJ	1UJ	1UJ	1UJ	R	1UJ	1U	1UJ
Aroclor-1254	0.5	1UJ	1.2U	1U	1UJ	1UJ	1UJ	1UJ	R	1UJ	1U	1UJ
Aroclor-1260	0.5	1UJ	1.2U	1U	1UJ	1UJ	1UJ	1UJ	R	1UJ	1U	1UJ
Dieldrin	0.03	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	.1U	0.1UJ
Endosulfan I	0.4	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ
Endosulfan II	0.4	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
Endosulfan sulfate	0.4	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
Endrin	2	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
Endrin aldehyde	--	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
Endrin ketone	--	0.1UJ	0.12U	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	R	0.1UJ	0.1U	0.1UJ
Heptachlor	0.4	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ
Heptachlor epoxide	0.2	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ
Methoxychlor	40	00.5UJ	0.6U	0.5U	00.5UJ	00.5UJ	00.5UJ	00.5UJ	R	00.5UJ	0.5U	00.5UJ
Toxaphene	3	5UJ	6U	5U	5UJ	5UJ	5UJ	5UJ	R	5UJ	5U	5UJ
alpha-BHC	0.02	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ
alpha-Chlordane	0.5	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05J	0.05U	0.05UJ
beta-BHC	0.2	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ
delta-BHC	--	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ
gamma-BHC (Lindane)	0.2	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ
gamma-Chlordane	0.5	0.05UJ	0.06U	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	R	0.05UJ	0.05U	0.05UJ

See last page for footnotes.



Table 5-13. Pesticide and Polychlorinated Biphenyl Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP* Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW9	GMMW10	GMMW11	GMMW13	GMMW14	GMMW15	GMMW17	GMMW19	GMMW20	GMMW21I
		Date: 01/23/95	01/23/95	01/25/95	01/27/95	01/23/95	01/24/95	01/25/95	01/27/95	01/23/95	01/26/95
4,4'-DDD	0.1	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.1U	0.1UJ	0.1UJ	0.1UJ
4,4'-DDE	0.1	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.069J	0.1UJ	0.1UJ	0.1UJ
4,4'-DDT	0.1	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.12	0.1UJ	0.1UJ	0.1UJ
Aldrin	0.04	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ
Aroclor-1016	0.5	1UJ	1UJ	1.2UJ	1UJ	1UJ	1UJ	1U	1UJ	1UJ	1UJ
Aroclor-1221	0.5	2UJ	2UJ	2.4UJ	2UJ	2UJ	2UJ	2U	2UJ	2UJ	2UJ
Aroclor-1232	0.5	1UJ	1UJ	1.2UJ	1UJ	1UJ	1UJ	1U	1UJ	1UJ	1UJ
Aroclor-1242	0.5	1UJ	1UJ	1.2UJ	1UJ	1UJ	1UJ	1U	1UJ	1UJ	1UJ
Aroclor-1248	0.5	1UJ	1UJ	1.2UJ	1UJ	1UJ	1UJ	1U	1UJ	1UJ	1UJ
Aroclor-1254	0.5	1UJ	1UJ	1.2UJ	1UJ	1UJ	1UJ	1U	1UJ	1UJ	1UJ
Aroclor-1260	0.5	1UJ	1UJ	1.2UJ	1UJ	1UJ	1UJ	1U	1UJ	1UJ	1UJ
Dieldrin	0.03	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.1U	0.1UJ	0.1UJ	0.1UJ
Endosulfan I	0.4	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ
Endosulfan II	0.4	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.1U	0.1UJ	0.1UJ	0.1UJ
Endosulfan sulfate	0.4	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.1U	0.1UJ	0.1UJ	0.1UJ
Endrin	2	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.1U	0.1UJ	0.1UJ	0.1UJ
Endrin aldehyde	--	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.1U	0.1UJ	0.1UJ	0.1UJ
Endrin ketone	--	0.1UJ	0.1UJ	0.12UJ	0.1UJ	0.1UJ	0.1UJ	0.1U	0.1UJ	0.1UJ	0.1UJ
Heptachlor	0.4	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ
Heptachlor epoxide	0.2	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ
Methoxychlor	40	0.5UJ	0.5UJ	0.59UJ	0.5UJ	0.5UJ	0.5UJ	0.5U	0.5UJ	0.5UJ	0.5UJ
Toxaphene	3	5UJ	5UJ	5.9UJ	5UJ	5UJ	5UJ	5U	5UJ	5UJ	5UJ
alpha-BHC	0.02	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	5J
alpha-Chlordane	0.5	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ
beta-BHC	0.2	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ
delta-BHC	--	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	3.8J
gamma-BHC (Lindane)	0.2	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ
gamma-Chlordane	0.5	0.05UJ	0.05UJ	0.059UJ	0.05UJ	0.05UJ	0.05UJ	0.05U	0.05UJ	0.05UJ	0.05UJ

See last page for footnotes.



Table 5-13. Pesticide and Polychlorinated Biphenyl Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP* Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW21D GMMW22D GMMW23I GMMW23D GMMW23DFR GMMW24I GMMW24IFR GMMW24D MW6 MW9									
		Date: 01/24/95 01/27/95 01/28/95 01/26/95 01/26/95 01/24/95 01/24/95 01/24/95 01/24/95 01/24/95									
4,4'-DDD	0.1	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
4,4'-DDE	0.1	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
4,4'-DDT	0.1	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
Aldrin	0.04	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
Aroclor-1018	0.5	1U	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ
Aroclor-1221	0.5	2U	2UJ	2UJ	2UJ	2UJ	2UJ	2UJ	2UJ	2UJ	2UJ
Aroclor-1232	0.5	1U	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ
Aroclor-1242	0.5	1U	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ
Aroclor-1248	0.5	1U	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ
Aroclor-1254	0.5	1U	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ
Aroclor-1260	0.5	1U	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ	1UJ
Dieldrin	0.03	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
Endosulfan-I	0.4	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
Endosulfan II	0.4	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
Endosulfan sulfate	0.4	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
Endrin	2	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
Endrin aldehyde	--	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
Endrin ketone	--	0.1U	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ	0.1UJ
Heptachlor	0.4	0.05U	.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
Heptachlor epoxide	0.2	0.05U	.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
Methoxychlor	40	0.5U	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.1UJ	0.5UJ	0.5UJ
Toxaphene	3	5U	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ	5UJ
alpha-BHC	0.02	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
alpha-Chlordane	0.5	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
beta-BHC	0.2	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
delta-BHC	--	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
gamma-BHC (Lindane)	0.2	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ
gamma-Chlordane	0.5	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ

See last page for footnotes.



Table 5-13. Pesticide and Polychlorinated Biphenyl Compounds in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP* Groundwater Quality Standard (Higher of PQLs)	Sample ID: MW10	PKMW-4	FBA1-012395	FBA2-012495	FBA3-012595	FBA4-012695	FBA5-012795
		Date: 01/23/95	01/27/95	01/23/95	01/24/95	01/25/95	01/26/95	01/27/95
4,4'-DDD	0.1	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.0066J	0.1U
4,4'-DDE	0.1	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.1U	0.1U
4,4'-DDT	0.1	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.0033J	0.1U
Aldrin	0.04	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
Aroclor-1018	0.5	1UJ	1UJ	1U	1U	1U	1U	1U
Aroclor-1221	0.5	2UJ	2UJ	2U	2U	2U	2U	2U
Aroclor-1232	0.5	1UJ	1UJ	1U	1U	1U	1U	1U
Aroclor-1242	0.5	1UJ	1UJ	1U	1U	1U	1U	1U
Aroclor-1248	0.5	1UJ	1UJ	1U	1U	1U	1U	1U
Aroclor-1254	0.5	1UJ	1UJ	1U	1U	1U	1U	1U
Aroclor-1260	0.5	1UJ	1UJ	1U	1U	1U	1U	1U
Dieldrin	0.03	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.1U	0.1U
Endosulfan I	0.4	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
Endosulfan II	0.4	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.1U	0.1U
Endosulfan sulfate	0.4	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.1U	0.1U
Endrin	2	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.002J	0.1U
Endrin aldehyde	--	0.1UJ	0.1UJ	0.1U	0.1U	0.034J	0.1U	0.1U
Endrin ketone	--	0.1UJ	0.1UJ	0.1U	0.1U	0.1U	0.1U	0.1U
Heptachlor	0.4	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
Heptachlor epoxide	0.2	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
Methoxychlor	40	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
Toxaphene	3	5UJ	5UJ	5U	5U	5U	5U	5U
alpha-BHC	0.02	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
alpha-Chlordane	0.5	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
beta-BHC	0.2	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
delta-BHC	--	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
gamma-BHC (Lindane)	0.2	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U
gamma-Chlordane	0.5	0.05UJ	0.05UJ	0.05U	0.05U	0.05U	0.05U	0.05U

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per liter (ug/L) (equivalent to parts per billion (ppb)).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols contained in the Statement of Work (SOW) OLM01.8.

Exceedances of NJDEP criteria are shown in bold and are underlined.

FBA Indicates a field blank associated with aqueous samples.

PQL Practical quantitation level.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specific detection limit.

J Estimated result.

R Rejected result.

-- No applicable criteria.

* NJDEP Groundwater Standards, New Jersey Register, April 5, 1993.



Table 5-14. Dissolved Metals in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: EB1 EB29 EB51 EB68 EBR13 EBR19 GMMW2 GMMW3 GMMW4 GMMW6 GMMW8 GMMW9											
		Date: 01/26/95	01/26/95	01/25/95	01/24/95	01/27/95	01/24/95	01/25/95	01/25/95	01/25/95	01/25/95	01/23/95	01/23/95
Aluminum	200	110U	171U	104U	33.8UJ	1450U	119UJ	<u>361J</u>	116J	68.5U	142U	75.6UJ	51.8J
Antimony	20	41.1U	41.1U	41.1U	41.1U	411U	<u>162</u>	41.1U	41.1U	41.1U	41.1U	41.1U	41.1U
Arsenic	8	11.3U	2.2U	8.8U	22UJ	2.8U	22UJ	<u>35.8</u>	<u>22.3</u>	2.5U	<u>43.9</u>	2.2UJ	2.2UJ
Barium	2000	79J	62.8J	83J	9.9U	36.7J	144J	16.3J	46.8J	60J	35.8J	508	1230
Beryllium	20	0.2U	0.2U	0.2U	1.7U	2U	<u>158</u>	1.1U	0.2U	0.2U	0.2U	0.2U	0.2U
Cadmium	4	4.4UJ	4.4UJ	4.4UJ	4.4U	44UJ	<u>175</u>	4.4U	4.4UJ	4.4UJ	4.4UJ	4.4U	4.4U
Calcium	--	179000	22000	77200	4570U	82600	2150U	8110	56700	55300	46300	128000	127000
Chromium	100	5.7U	5.7U	5.7U	5.7U	57U	<u>173</u>	67.7	5.7U	5.7U	57.6	5.7U	5.7U
Cobalt	100 **	12.6U	12.6U	12.6U	12.6U	126U	<u>174</u>	12.6U	14.4J	12.6U	12.6U	12.6U	12.6U
Copper	1000	2.5U	12.5J	2.5U	2.5U	25U	146	2.5U	2.5U	2.5U	2.5U	2.5U	2.5U
Iron	300	<u>899</u>	63.1J	<u>8160</u>	566U	<u>315J</u>	199U	<u>415</u>	<u>5770</u>	<u>2480</u>	<u>473</u>	<u>17700</u>	2780U
Lead	10	1.6UJ	<u>17.8J</u>	1.6UJ	1.6UJ	1.6UJ	16UJ	1.6U	1.6UJ	1.6UJ	1.6UJ	1.6UJ	1.6UJ
Magnesium	--	8490	2590J	66500	2230U	153000	1780U	3080J	24500	33900	53200	26800	99500
Manganese	50	48.3	<u>55.3</u>	<u>498</u>	16UJ	<u>83.4J</u>	<u>171J</u>	6.3UJ	<u>236J</u>	<u>206</u>	<u>65.5</u>	<u>616J</u>	<u>360J</u>
Mercury	2	0.2U	0.2U	0.2U	0.2	0.21J	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
Molybdenum	--	13U	13U	13U	13U	13UJ	18.9J	13U	13U	13U	13U	13U	13U
Nickel	100	17.8U	20J	17.8U	17.8U	178U	<u>168</u>	17.8U	17.8U	17.8U	67.2	17.8U	17.8U
Palladium	--	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ
Potassium	--	5480	844U	20500	943U	52900	810U	19700	8440	8840	3650J	10200	27800
Selenium	50	2.7UJ	2.7UJ	27U	27UJ	27U	27UJ	27UJ	27UJ	2.7UJ	2.7UJ	27UJ	27UJ
Silver	--	4.5UJ	4.5UJ	4.5UJ	4.5UJ	45UJ	9.8UJ	4.5UJ	4.5UJ	4.5UJ	4.5UJ	4.5UJ	4.5UJ
Sodium	50000	16000	3190J	93.8U	89300U	<u>1260000</u>	2270U	<u>376000</u>	<u>122000</u>	<u>126000</u>	<u>51000</u>	<u>140000</u>	368000U
Thallium	10	R	R	R	R	R	R	R	R	R	R	R	R
Vanadium	100 **	6.4J	2.9U	2.9U	3.3U	29U	<u>166</u>	<u>389</u>	5.1U	6.3J	2.9U	2.9U	2.9U
Zinc	5000	8.3J	360	3.1U	3.1UJ	31U	164	13.5J	17.5J	3.1U	34.5	83U	44.2
Hexavalent chromium	--	R	R	R	50UJ	R	50UJ	50UJ	50UJ	R	R	50UJ	50UJ

See last page for footnotes.



Table 5-14. Dissolved Metals in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW10 GMMW11 GMMW13 GMMW14 GMMW15 GMMW17 GMMW19 GMMW20 GMMW21I GMMW21D GMMW22D										
		Date: 01/23/95	01/25/95	01/27/95	01/23/95	01/24/95	01/25/95	01/27/95	01/23/95	01/26/95	01/24/95	01/27/95
Aluminum	200	33.8UJ	164U	122U	94.9UJ	<u>94300J</u>	129J	112U	<u>1060J</u>	1240U	<u>908</u>	160U
Antimony	20	41.1U	41.1U	41.1U	79.4U	41.1U	41.1U	41.1U	411U	411U	41.1U	41.1U
Arsenic	8	5.1J	18.2U	3.6U	<u>2970J</u>	2.2UJ	2.2UJ	<u>916</u>	5.9J	10.2U	3.1U	2.2U
Barium	2000	463	45.5J	75.1J	67.9J	1.8U	83J	106J	1780J	28J	32.6J	20.9J
Beryllium	20	0.2U	0.2U	0.2U	74.6U	2.4U	0.2U	0.2U	2U	2U	0.72U	0.2U
Cadmium	4	4.4U	4.4UJ	4.4UJ	83.2U	4.4U	4.4U	4.4UJ	44UJ	44UJ	4.4UJ	4.4UJ
Calcium	--	109000	7280	84900	1260U	114000	50900	176000	531000	55700	117000	78500
Chromium	100	5.7U	5.7U	5.7U	83.2U	5.9J	<u>410</u>	5.7U	57U	57U	5.9J	5.7U
Cobalt	100 **	12.6U	12.6U	12.6U	83U	12.6U	12.6U	12.6U	126U	126U	19.8J	12.6U
Copper	1000	2.5U	3.4J	2.5U	69.7U	2.7U	4.9U	2.5U	25U	25U	4.1J	2.5U
Iron	300	<u>19400</u>	52.6J	<u>1590</u>	120U	<u>38900</u>	36.1J	<u>946</u>	<u>89600</u>	208U	<u>7100</u>	<u>1620</u>
Lead	10	1.6UJ	1.6UJ	1.6UJ	<u>37.4</u>	1.6U	1.6UJ	1.6UJ	1.6UJ	1.6UJ	1.6UJ	1.6UJ
Magnesium	--	36800	6360	6440	933U	107000	39500	24300	116000	43300J	10600	7600
Manganese	50	<u>525J</u>	<u>791</u>	<u>160</u>	81.5UJ	1U	30.5J	<u>524</u>	<u>1130J</u>	<u>400</u>	<u>1040</u>	<u>234</u>
Mercury	2	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
Molybdenum	--	13U	13U	13U	13U	13U	25.7J	13U	13UJ	24.4J	13U	13U
Nickel	100	17.8U	17.8U	17.8U	81.4U	17.8U	64.2	17.8U	178U	178U	31.8J	17.8U
Palladium	--	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	20.1J	16.9UJ	16.9UJ	16.9UJ
Potassium	--	17100	10500	3550J	341U	341U	6230	13500J	46700J	38300J	49600	7530
Selenium	50	27UJ	2.7UJ	2.7U	27UJ	27UJ	5.3J	2.7UJ	27UJ	27U	2.7UJ	2.7U
Silver	--	4.5UJ	4.5UJ	4.5UJ	7.4UJ	4.5UJ	4.5UJ	4.5UJ	45UJ	45UJ	4.5UJ	4.5UJ
Sodium	50000	<u>257000</u>	<u>197000</u>	24500	1100U	279U	35800	<u>144000</u>	<u>1230000</u>	<u>632000</u>	<u>159000</u>	33600
Thallium	10	R	R	R	R	R	R	R	R	R	R	R
Vanadium	100 **	2.9U	28.8J	56.9	79.7U	7.7U	2.9U	2.9U	29U	29U	8.7J	2.9U
Zinc	5000	3.1UJ	3.1U	3.1U	77.2U	3.1UJ	64.7	3.1U	31UJ	31U	186	56.1
Hexavalent chromium	50	50UJ	R	R	50UJ	50UJ	330J	R	50UJ	R	R	R

See last page for footnotes.



Table 5-14. Dissolved Metals in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW23I GMMW23D GMMW23DFR GMMW24I GMMW24IFR GMMW24D MW6 MW9 MW10								
		Date: 01/26/95	01/26/95	01/26/95	01/24/95	01/24/95	01/24/95	01/24/95	01/24/95	01/23/95
Aluminum	200	172U	387U	484U	50.3J	93.98J	33.8UJ	90.7J	<u>512000J</u>	33.8UJ
Antimony	20	41.1U	41.1U	41.1U	<u>121</u>	<u>167</u>	41.1U	<u>151</u>	41.1U	41.1U
Arsenic	8	<u>32.5</u>	2.2U	2.2U	2.8J	2.7J	2.2UJ	<u>51.5J</u>	2.2UJ	2.2UJ
Barium	2000	341	34.8J	33.5J	101J	132J	11.4U	118J	1.1U	3.3U
Beryllium	20	0.2U	0.2U	0.2U	<u>110</u>	<u>146</u>	2.3U	<u>129</u>	0.2U	0.2U
Cadmium	4	4.4UJ	4.4UJ	4.4UJ ^c	<u>124</u>	<u>164</u>	4.4U	<u>146</u>	4.4U	4.4U
Calcium	--	28500	63900	74800	1370U	1880U	4800U	1850U	513000	10100
Chromium	100	5.7U	5.7U	5.7U	<u>119</u>	<u>161</u>	5.7U	<u>142</u>	20.1	5.7U
Cobalt	100 **	12.6U	12.6U	12.6U	<u>122</u>	<u>157</u>	12.6U	<u>140</u>	12.6U	12.6U
Copper	1000	5.9J	7.1J	3.4J	102	134	3.8U	119	R	6U
Iron	300	<u>3620</u>	189	205	102U	138U	614U	144U	<u>182000</u>	<u>765</u>
Lead	10	1.6UJ	1.6UJ	1.6UJ	1.6UJ	1.6UJ	4.2J	2J	1.6UJ	2.2J
Magnesium	--	21900	8490	11300	1230U	1650U	2300U	1490U	547000	9180
Manganese	50	<u>803</u>	41.8J	<u>120J</u>	<u>119J</u>	<u>158J</u>	17.5UJ	<u>139J</u>	1UJ	30.2UJ
Mercury	2	0.2U	0.2U	0.2U	0.25	0.2U	0.2U	0.2U	0.2U	0.24
Molybdenum	--	29.8J	31.1J	33.8J	13U	13U	13U	17.8J	13U	13U
Nickel	100	17.8U	17.8U	17.8U	<u>118</u>	<u>155</u>	17.8U	135U	17.8U	91U
Palladium	--	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ	16.9UJ
Potassium	--	16600	34600	30300	571UJ	1100UJ	1070U	767U	341U	8590
Selenium	50	2.7UJ	2.7UJ	2.7UJ	2.7UJ	2.7UJ	2.7UJ	2.7UJ	27UJ	27UJ
Silver	--	4.5UJ	4.5UJ	4.5UJ	8.2UJ	10.9UJ	4.5UJ	9.6UJ	4.5UJ	4.5UJ
Sodium	50000	<u>313000</u>	<u>188000</u>	<u>183000</u>	1280U	1810U	69800U	2140U	123U	<u>473000</u>
Thallium	10	R	R	R	R	R	R	R	R	R
Vanadium	100 **	2.9U	4J	2.9U	117	<u>154</u>	4U	<u>136</u>	R	3.6U
Zinc	5000	22.8	15.4J	5J	114	149	3.1UJ	136	3.1UJ	3.9U
Hexavalent chromium	--	R	R	R	50UJ	50UJ	50UJ	50UJ	50UJ	50UJ

See last page for footnotes.



Table 5-14. Dissolved Metals in Groundwater Samples Collected During the Phase 1A Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: PKMW-4	FBA1-012395	FBA2-012495	FBA3-012595	FBA4-012695	FBA5-012795
		Date: 01/27/95	01/23/95	01/24/95	01/25/95	01/26/95	01/27/95
Aluminum	200	1180U	70.2J	33.8U	33.8U	115J	87.9J
Antimony	20	411U	<u>106</u>	41.1U	41.1U	41.1U	41.1U
Arsenic	8	7U	2.2UJ	2.2U	2.2UJ	2.2U	2.2U
Barium	2000	148J	72.1J	11.2J	0.6U	0.62J	0.69J
Beryllium	20	0.2U	80.7U	1.8J	0.2U	0.2U	0.2U
Cadmium	4	44UJ	<u>93.4</u>	4.4U	4.4U	4.4U	4.4U
Calcium	--	336000	1220J	5290	53.7U	61.2J	53.7U
Chromium	100	57U	87.3	5.7U	5.7U	5.7U	5.7U
Cobalt	100 **	126U	91.3	12.6U	12.6U	12.6U	12.6U
Copper	1000	25U	73.5	2.5U	2.5U	2.5U	2.5U
Iron	300	<u>315J</u>	108	<u>638</u>	20.8U	20.8U	20.8U
Lead	10	1.6UJ	1.6U	1.6U	1.6U	1.6U	1.6U
Magnesium	--	205000	962J	2620J	27.3U	27.3U	27.3U
Manganese	50	<u>1170</u>	<u>87</u>	18.2	1U	1U	1U
Mercury	2	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U
Molybdenum	--	13UJ	13U	13U	13U	13U	13U
Nickel	100	178U	86.4	17.8U	17.8U	17.8U	17.8U
Palladium	--	16.9UJ	16.9U	16.9U	16.9U	16.9U	16.9U
Potassium	--	53500	341U	1080J	341U	341U	450J
Selenium	50	27U	2.7U	2.7U	2.7U	2.7U	2.7U
Silver	--	45UJ	8.8J	4.5U	4.5U	4.5U	4.5U
Sodium	50000	<u>1410000</u>	1070J	<u>82700</u>	364J	568J	334J
Thallium	10	R	2.7UJ	2.7UJ	2.7UJ	2.7U	2.7U
Vanadium	100 **	29U	85.5	3.3J	2.9U	2.9U	2.9U
Zinc	5000	31U	81	3.1U	3.1U	3.1U	3.1U
Hexavalent chromium	50	R	50U	50U	50U	50U	50U

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per liter (ug/L) (equivalent to parts per billion [ppb]). Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols co Statement of Work (SOW) ILM03.O.

Exceedances of NJDEP criteria are shown in bold and are underlined.

FBA Indicates a field blank associated with aqueous samples.

FR Field replicate of previous sample.

U The compound was analyzed for but not detected at the specified detection limit.

J Estimated result.

-- No applicable criteria.

R Rejected result.

* NJDEP Groundwater Standards, New Jersey Register, April 5, 1993.

** Interim generic groundwater quality criterion.



Table 5-15. Total Metals and Cyanide in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: EB01	EB29	EB51	EB68	EBR13	EBR19	GMMW2	GMMW3	GMMW4	GMMW6	GMMW8	GMMW9	GMMW10
		Date: 01/26/95	01/26/95	01/25/95	01/24/95	01/27/95	01/24/95	01/25/95	01/25/95	01/25/95	01/25/95	01/23/95	01/23/95	01/23/95
Aluminum	200	<u>528J</u>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	20	8.9J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	8	<u>16.4</u>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	2000	84.1J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	20	0.1U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	4	0.5U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	147000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	2.9U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	100**	1J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	1000	26.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	200	10U	10U	10UJ	10UJ	10U	10UJ	10UJ	10UJ	10U	10U	10UJ	10UJ	17.2J
Iron	300	<u>2700</u>	<u>13700</u>	<u>9590J</u>	<u>45400J</u>	<u>5810</u>	<u>46000</u>	<u>51700</u>	<u>62900</u>	NA	NA	<u>74800</u>	<u>146000</u>	<u>86300</u>
Lead	10	<u>66.9J</u>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	7190	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	50	<u>52.4</u>	<u>305</u>	<u>509J</u>	<u>480J</u>	<u>80.6</u>	<u>243</u>	<u>884</u>	<u>491</u>	NA	NA	<u>849</u>	<u>1140</u>	<u>874</u>
Mercury	2	1.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	100	15.4J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	7080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	50	4.4U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	--	0.6U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	50000	14200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	10	5.5U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	100**	10.8J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	5000	161J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See last page for footnotes.



Table 5-15. Total Metals and Cyanide in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW11 GMMW13 GMMW14 GMMW15 GMMW17 GMMW19 GMMW20 GMMW21I GMMW21D GMMW22D GMMW23I										
		Date: 01/25/95 01/27/95 01/23/95 01/24/95 01/25/95 01/27/95 01/23/95 01/26/95 01/24/95 01/27/95 01/28/95										
Aluminum	200	NA	NA	NA	NA	NA	NA	NA	<u>280J</u>	<u>1200J</u>	NA	<u>1300J</u>
Antimony	20	NA	NA	NA	NA	NA	NA	NA	1.9U	1.9U	NA	1.9J
Arsenic	8	NA	NA	NA	NA	NA	NA	NA	<u>26.3</u>	5.8J	NA	<u>29.6</u>
Barium	2000	NA	NA	NA	NA	NA	NA	NA	27.8J	30.4J	NA	332
Beryllium	20	NA	NA	NA	NA	NA	NA	NA	0.1U	0.74U	NA	0.1U
Cadmium	4	NA	NA	NA	NA	NA	NA	NA	0.5U	0.5U	NA	0.5U
Calcium	--	NA	NA	NA	NA	NA	NA	NA	51100	99500	NA	24400
Chromium	--	NA	NA	NA	NA	NA	NA	NA	6.4U	11U	NA	5.5U
Cobalt	100**	NA	NA	NA	NA	NA	NA	NA	3.7J	15.8J	NA	4.9J
Copper	1000	NA	NA	NA	NA	NA	NA	NA	103	49.1	NA	20.3J
Cyanide	200	10U	10U	10UJ	10UJ	13.7J	10U	10U	10U	10U	10U	10U
Iron	300	<u>54500</u>	<u>38400</u>	<u>26200</u>	<u>85400J</u>	<u>12800</u>	NA	NA	<u>798</u>	<u>6730</u>	<u>3210</u>	<u>5140</u>
Lead	10	NA	NA	NA	NA	NA	NA	NA	7.2J	7.6J	NA	<u>11.8J</u>
Magnesium	--	NA	NA	NA	NA	NA	NA	NA	39500	9180	NA	18500
Manganese	50	<u>2490</u>	<u>340</u>	<u>97.2</u>	<u>725J</u>	<u>84.4</u>	NA	NA	<u>402</u>	<u>907</u>	<u>230</u>	<u>662</u>
Mercury	2	NA	NA	NA	NA	NA	NA	NA	0.2U	0.2U	NA	0.2U
Nickel	100	NA	NA	NA	NA	NA	NA	NA	11.6J	33.8J	NA	7.5U
Potassium	--	NA	NA	NA	NA	NA	NA	NA	6560C	51200	NA	24500
Selenium	50	NA	NA	NA	NA	NA	NA	NA	4.4U	5.7	NA	4.4U
Silver	--	NA	NA	NA	NA	NA	NA	NA	0.6U	0.6U	NA	0.6U
Sodium	50000	NA	NA	NA	NA	NA	NA	NA	<u>545000</u>	<u>131000</u>	NA	<u>250000</u>
Thallium	10	NA	NA	NA	NA	NA	NA	NA	5.5U	5.5U	NA	5.5U
Vanadium	100**	NA	NA	NA	NA	NA	NA	NA	6.2J	10J	NA	5.1J
Zinc	5000	NA	NA	NA	NA	NA	NA	NA	63.7J	151J	NA	30.8J

See last page for footnotes.



Table 5-15. Total Metals and Cyanide in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: GMMW23D	GMMW23DFR	GMMW24I	GMMW24IFR	GMMW24D	MW6	MW9	MW10	PKMW-4	FBA001-012395
		Date: 01/26/95	01/26/95	01/24/95	01/24/95	01/24/95	01/24/95	01/24/95	01/23/95	01/27/95	01/23/95
Aluminum	200	<u>17400J</u>	<u>13300J</u>	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	20	1.9U	1.9U	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	8	<u>9.1J</u>	<u>10.4</u>	NA	NA	NA	NA	NA	NA	NA	NA
Barium	2000	296	275	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	20	1.2U	1.1U	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	4	0.5U	0.5U	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	112000	100000	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	37.4	34.2	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	100**	14.7J	13.4J	NA	NA	NA	NA	NA	NA	NA	NA
Copper	1000	68.9	63.4	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	200	10U	10U	10UJ	10UJ	10UJ	10UJ	10UJ	10UJ	10U	10U
Iron	300	<u>22200</u>	<u>19200</u>	<u>3920</u>	<u>3190J</u>	<u>1710</u>	<u>69700</u>	<u>10900</u>	<u>7620</u>	<u>2800</u>	71J
Lead	10	<u>27.6J</u>	<u>23.6J</u>	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	17600	14800	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	50	<u>509</u>	<u>398</u>	<u>790</u>	<u>817J</u>	<u>90.4</u>	<u>760</u>	<u>251</u>	<u>79</u>	<u>414</u>	1U
Mercury	2	0.2U	0.2U	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	100	26.9J	24.7J	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	62500	56900	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	50	6.6	7.9	NA	NA	NA	NA	NA	NA	NA	NA
Silver	--	0.6U	0.6U	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	50000	<u>212000</u>	<u>191000</u>	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	10	5.5U	5.5U	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	100**	38.3J	33.4J	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	5000	105J	109J	NA	NA	NA	NA	NA	NA	NA	NA

See last page for footnotes.



Table 5-15. Total Metals and Cyanide in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (ug/L)	NJDEP * Groundwater Quality Standard (Higher of PQLs)	Sample ID: FBA002-012495 FBA003-012595 FBA004-012695 FBA005-012795			
		Date: 01/24/95	01/25/95	01/26/95	01/27/95
Aluminum	200	NA	NA	65.3J	NA
Antimony	20	NA	NA	1.9U	NA
Arsenic	8	NA	NA	3.5U	NA
Barium	2000	NA	NA	0.38J	NA
Beryllium	20	NA	NA	0.1U	NA
Cadmium	4	NA	NA	0.5U	NA
Calcium	--	NA	NA	35J	NA
Chromium	--	NA	NA	2.2U	NA
Cobalt	100**	NA	NA	0.5U	NA
Copper	1000	NA	NA	0.8U	NA
Cyanide	200	10U	10U	10U	10U
Iron	300	43.7J	137	38.9J	27.2U
Lead	10	NA	NA	1.6U	NA
Magnesium	--	NA	NA	18.4J	NA
Manganese	50	1U	1U	0.4U	0.53J
Mercury	2	NA	NA	0.2U	NA
Nickel	100	NA	NA	1.5U	NA
Potassium	--	NA	NA	108J	NA
Selenium	50	NA	NA	4.4U	NA
Silver	--	NA	NA	0.6U	NA
Sodium	50000	NA	NA	544J	NA
Thallium	10	NA	NA	5.5U	NA
Vanadium	100**	NA	NA	0.5U	NA
Zinc	5000	NA	NA	1.3J	NA

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in micrograms per liter (ug/L) (equivalent to parts per billion [ppb]).

Analyses were performed by CompuChem Environmental Corporation, Research Triangle Park, North Carolina, using Contract Laboratory Program (CLP) protocols contained in the Statement of Work (SOW) ILM03.O.

Exceedances of NJDEP criteria are shown in bold and are underlined.

FBA Indicates a field blank associated with aqueous samples.

PQL Practical quantitation level.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specified detection limit.

J Estimated result.

-- No applicable criteria.

NA Not analyzed.

* NJDEP Groundwater Standards, New Jersey Register, April 5, 1993.

** Interim generic groundwater quality criterion.



Table 5-18. Wet Chemistry, Intrinsic Biological Parameters, and Dissolved Gases in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/L)	NJDEP * Groundwater Quality Standards (Higher of PQLs)	Sample ID: EB1 Date: 01/26/95	EB29 01/26/95	EB51 01/25/95	EB68 01/24/95	EBR13 01/27/95	EBR19 01/24/95	GMMW2 01/25/95	GMMW3 01/25/95	GMMW8 01/23/95	GMMW9 01/23/95	GMMW10 01/23/95	GMMW11 01/25/95
Ammonia	0.5	0.1U	0.1U	<u>1.46</u>	<u>2.88</u>	<u>1.08</u>	0.205	<u>4.28</u>	<u>0.9</u>	<u>2.16</u>	<u>1.77</u>	<u>4.8</u>	<u>1.33</u>
BOD, 5-day total	--	7.6	7.8	12	70	65	15	34	39	10	28	34	4.8
Carbon dioxide	--	56.1	13.1	62.9	<u>37.8</u>	33.4	1.6U	1.6U	153.4	44.4	112.4	103	2.5
Carbon monoxide	--	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U
Chemical oxygen demand	--	86	370	91	400	190	790	470	430	340	800	710	140
Chloride	250	12.4	5.47	<u>1780J**</u>	<u>5580J**</u>	<u>2430</u>	<u>11300J**</u>	220J**	204J**	203J**	<u>782J**</u>	<u>431J**</u>	65.7
Methane	--	0.3	0.2U	5.3	2.5	0.2U	0.2U	6.3	9.3	2.7	10.4	13.2	0.2U
Nitrate-N	10	0.33	3.2	0.04U	0.04U	0.04U	0.04U	0.042	0.04U	0.048	0.4	0.04U	0.04U
Nitrogen dioxide	--	12.2	12.6	9.9	11.3	12.8	12.4	12.6	5.7	11.9	5.2	4.0	11.2
Total organic carbon	--	28.7	9.4	15.4	21.1	22.4	12.1	76.7	27.2	32.2	21.3	100	28.8
Dissolved oxygen	--	2.4	7.0	1.1	1.6	0.9	2.6	2.0	2.5	1.6	1.1	1.0	2.6
Sulfate	250	<u>300</u>	24.6	62.9	240	70.6	<u>1840</u>	194J**	28.7	38	28.8	27.7	29.9
Sulfide, low	--	0.2	0.1U	0.2	62	83	16	0.8	0.52	5.1	7.8	6	0.59
Total dissolved solids	500	<u>2010</u>	150	204J**	378J**	<u>3320</u>	<u>3670J**</u>	162J**	152J**	4100UJ*	4320UJ*	224J**	202
Total alkalinity	--	411	10.7	490	720	393	54.5	486	211	436	430	432	427
Total phosphorus	--	0.1U	0.734	0.971	1.99	0.321	0.371	4.44	0.68	1.94	1.55	1.95	8.71

See last page for footnotes.



Table 5-16. Wet Chemistry, Intrinsic Biological Parameters, and Dissolved Gases in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/L)	NJDEP * Groundwater Quality Standards (Higher of PQLs)	Sample ID: GMMW13 GMMW14 GMMW15 GMMW17 GMMW21I GMMW21D GMMW22D GMMW23I GMMW23D GMMW23DFR									
		Date: 01/27/95	01/23/95	01/24/95	01/25/95	01/26/95	01/24/95	01/27/95	01/26/95	01/26/95	01/26/95
Ammonia	0.5	<u>1.08</u>	<u>1.90</u>	<u>5.01</u>	0.1U	0.1U	0.1U	0.1U	0.1U	0.136	0.1U
BOD, 5-day total	--	33	43	74	6.4	240	1600	420	700	430	430
Carbon dioxide	--	82	114.5	80.2	2.2	35	151.8	38.8	228.4	1.6U	1.6U
Carbon monoxide	--	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U
Chemical oxygen demand	--	200	240	720	91	250	2200	660	850	1700	1600
Chloride	250	27.8	242	<u>1750</u>	17.1	159	211J**	49.6	185	<u>302</u>	<u>298J**</u>
Methane	--	2.4	10.9	5.4	1.5	3	0.2U	0.2U	0.6	0.2U	0.2U
Nitrate-N	10	0.04U	0.04U	0.04U	0.45	0.04U	0.04U	0.04U	0.04U	0.063	0.087
Nitrogen dioxide	--	12.9	7.2	8.4	12.7	8.1	9.9	14.1	4.6	13.5	12.7
Total organic carbon	--	98.6	27.6	42.2	15.2	98.8	719	235	345	515	563
Dissolved oxygen	--	0.9	1.1	0.6	2.9	1.3	1.7	1.0	1.0	0.9	1.0
Sulfate	250	12.5	87.7	78.4	117	<u>364</u>	<u>427J**</u>	<u>701</u>	33.3	<u>396</u>	<u>473J**</u>
Sulfide, low	--	4.1	13	20	0.43	11	0.17	0.1U	0.1U	0.1U	0.1U
Total dissolved solids	500	182	492	<u>4240</u>	146	<u>4060</u>	322J**	<u>900</u>	<u>2020</u>	<u>1920</u>	260J**
Total alkalinity	--	233	425	991	206	1210	221	73	440	33.6	44.7
Total phosphorus	--	1.86	2.25	3.99	0.154	0.647	0.527	0.275	0.495	0.982	0.894

See last page for footnotes.



Table 5-16. Wet Chemistry, Intrinsic Biological Parameters, and Dissolved Gases in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/L)	NJDEP * Groundwater Quality Standards (Higher of PQLs)	Sample ID: GMMW24I	GMMW24IFR	GMMW24D	MW6	MW9	MW10	PKMW-4	FBA1-012395	FBA2-012495
		Date: 01/24/95	01/24/95	01/24/95	01/24/95	01/24/95	01/23/95	01/27/95	01/23/95	01/24/95
Ammonia	0.5	0.1U	0.1U	0.1U	<u>4.15</u>	<u>3.44</u>	0.1U	<u>2.92</u>	0.1U	0.1U
BOD, 5-day total	--	710	1900	18	66	14	37	78	9.1	4U
Carbon dioxide	--	153	175.6	1.6U	103.3	131.7	23.7	54.6	NA	NA
Carbon monoxide	--	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	NA	NA
Chemical oxygen demand	--	3600	3700	87	390	140	270	430	20U	20U
Chloride	250	<u>2280</u>	<u>1270</u>	154J**	<u>346</u>	99.7	23.5	<u>3310J**</u>	3U	3U
Methane	--	0.3	0.4	0.2U	4.9	10.1	13.4	2.6	NA	NA
Nitrate-N	10	0.04U	0.04U	0.04U	0.08	0.04U	0.04U	0.04U	0.04U	0.04U
Nitrogen dioxide	--	9.2	10.7	15.1	13.1	7.2	8.8	10.6	NA	NA
Total organic carbon	--	1220	1290	15.2	83.7	20.2	43.8	77.1	4.13	1U
Dissolved oxygen	--	1.5	1.3	4.0	2.5	2.8	2.7	0.7	NA	NA
Sulfate	250	81.5	29.3	34.9	87.7	20	14	<u>582J**</u>	2U	2U
Sulfide, low	--	2.9	1.3	0.1U	1.7	0.18	0.1U	97	0.1U	0.1U
Total dissolved solids	500	<u>4340</u>	<u>6430</u>	106J**	<u>2680</u>	<u>4630</u>	210	178J**	3570U	<u>592J**</u>
Total alkalinity	--	451	369	58.5	322	185	1060	736	10U	10U
Total phosphorus	--	0.713	0.839	0.227	3.78	0.321	0.328	0.789	0.122	0.168

See last page for footnotes.



Table 5-16. Wet Chemistry, Intrinsic Biological Parameters, and Dissolved Gases in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Analyte (mg/L)	NJDEP * Groundwater Quality Standards (Higher of PQLs)	Sample ID: FBA3-012595 Date: 01/25/95	FBA4-012695 01/26/95	FBA5-012795 01/27/95
Ammonia	0.5	0.1U	0.1U	0.1U
BOD, 5-day total	--	4U	4.0U	4U
Carbon dioxide	--	NA	NA	NA
Carbon monoxide	--	NA	NA	NA
Chemical oxygen demand	--	20U	20U	20U
Chloride	250	3U	3U	3U
Methane	--	NA	NA	NA
Nitrate-N	10	0.04U	0.04U	0.04U
Nitrogen dioxide	--	NA	NA	NA
Total organic carbon	--	1U	1U	1U
Dissolved oxygen	--	NA	NA	NA
Sulfate	250	2U	2U	2U
Sulfide, low	--	0.1U	0.1U	0.1U
Total dissolved solids	500	138J**	4U	<u>2110J**</u>
Total alkalinity	--	10U	10U	10U
Total phosphorus	--	0.1U	0.1U	0.1U

Analyte concentrations and New Jersey Department of Environmental Protection (NJDEP) criteria in milligrams per liter (mg/L) (equivalent to parts per million [ppm]).

Analyses were performed by Compuchem Environmental Corporation of Research Park Triangle, North Carolina, using standard United States Environmental Protection Agency (USEPA) methodology.

Exceedances of the NJDEP criteria are shown in bold and are underlined.

FBA Indicates a field blank associated with aqueous samples.

PQL Practical quantitation level.

FR Field replicate of previous sample.

U The compound was analyzed for, but not detected at the specified detection limit.

J Estimated result.

NA Not analyzed.

-- No applicable criteria.

* NJDEP Groundwater Standards, New Jersey Register, April 5, 1993.

** Indicates a value reported by the laboratory where concentrations of chlorides and/or sulfates exceed the reported TDS concentration. These values are considered suspect.



Table 5-17. Summary of Detected Concentrations of All Constituents in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Groundwater Quality Criteria	Percent of Samples Exceeding NJDEP Groundwater Quality Criteria
<u>Volatile Organic Compounds (ug/L)</u>								
1,1-Dichloroethane	62.00	63.00	64.00	2	44	5	0	0
1,2-Dichloroethane(Total)	7.00	2961.00	11000.00	4	44	9	2	5
1-Butanol	24000.00	24000.00	24000.00	1	44	2	0	0
2-Butanol	26000.00	26000.00	26000.00	1	44	2	0	0
2-Butanone	2800.00	2800.00	2800.00	1	44	2	1	2
Acetone	19.00	1127.00	4300.00	4	44	9	1	2
Benzene	2.00	77944.00	710.00	18	44	41	18	41
Bromodichloromethane	2.00	6.00	10.00	2	44	5	2	5
Chlorobenzene	2.00	2836.50	14000.00	8	44	18	6	14
Chloroethane	65.00	65.00	65.00	1	44	2	0	0
Chloroform	2.00	17.50	40.00	4	44	9	3	7
Ethylbenzene	2.00	1556.25	12000.00	8	44	18	1	2
Hexane	9.00	1323.78	4700.00	9	44	20	0	0
Methyl-t-butyl ether	260.00	390.00	520.00	2	44	5	0	0
Methylene chloride	69.00	69.00	69.00	1	44	2	1	2
Tetrachloroethane	820.00	820.00	820.00	1	44	2	1	2
Toluene	1.00	54.40	510.00	10	44	23	0	0
Trichloroethane	1.00	550.50	1100.00	2	44	5	1	2
Vinyl chloride	3.00	1357.67	3700.00	3	44	7	2	5
Xylenes (Total)	2.00	2909.36	38000.00	14	44	32	4	9
n-Propylbenzene	2.00	387.13	2800.00	15	44	34	0	0
<u>Semivolatile Organic Compounds (ug/L)</u>								
1,2-Dichlorobenzene	1.00	8.00	19.00	4	31	13	0	0
1,3-Dichlorobenzene	18.00	18.00	18.00	1	31	3	0	0
1,4-Dichlorobenzene	2.00	34.75	130.00	4	31	13	1	3
2,4-Dichlorophenol	14.00	14.00	14.00	1	31	3	0	0
2,4-Dimethylphenol	1.00	55.50	110.00	2	31	6	1	3
2-Chlorophenol	17.00	17.00	17.00	1	31	3	0	0
2-Methylnaphthalene	1.00	45.25	310.00	12	31	39	2	6
2-Methylphenol	2.00	3.50	5.00	2	31	7	0	0
4-Methylphenol	2.00	37.00	180.00	7	31	23	0	0
Acenaphthene	1.00	5.89	15.00	9	31	29	0	0
Anthracene	2.00	2.00	2.00	2	31	6	0	0
Benzo(a)anthracene	1.00	2.13	5.00	8	31	26	0	0

See last page for footnotes.



Table 5-17. Summary of Detected Concentrations of All Constituents in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Groundwater Quality Criteria	Percent of Samples Exceeding NJDEP Groundwater Quality Criteria
<u>Semivolatile Organic Compounds (continued) (ug/L)</u>								
Benzo(a)pyrene	1.00	2.17	5.00	6	31	19	0	0
Benzo(b)fluoranthene	1.00	2.11	8.00	9	31	29	0	0
Benzo(g,h,i)perylene	2.00	2.00	2.00	1	31	3	0	0
Benzo(k)fluoranthene	1.00	2.22	9.00	9	31	29	0	0
Carbazole	2.00	3.00	4.00	3	31	10	0	0
Chrysene	1.00	2.18	4.00	11	31	35	0	0
Di-n-butyl phthalate	1.00	1.50	2.00	2	31	6	0	0
Dibenzofuran	2.00	4.25	9.00	4	31	13	0	0
Diethyl phthalate	1.00	1.00	1.00	4	31	13	0	0
Fluoranthene	1.00	2.40	6.00	10	31	32	0	0
Fluorene	1.00	6.10	19.00	10	31	32	0	0
Indeno(1,2,3-cd)pyrene	1.00	1.00	1.00	1	31	3	0	0
Naphthalene	1.00	30.07	180.00	14	31	45	4	13
Pentachlorophenol	3.00	3.00	3.00	1	31	3	1	3
Phenanthrene	1.00	7.54	32.00	13	31	42	0	0
Phenol	2.00	14.22	49.00	9	31	29	0	0
Pyrene	1.00	2.88	8.00	16	31	52	0	0
bis(2-Ethylhexyl)phthalate	1.00	5.54	16.00	24	31	77	0	0
<u>Pesticides/PCBs (ug/L)</u>								
4,4'-DDE	0.07	0.07	0.07	1	31	3	0	0
4,4'-DDT	0.12	0.12	0.12	1	31	3	1	3
alpha-BHC	5.00	5.00	5.00	1	31	3	1	3
alpha-chlordane	0.05	0.05	0.05	1	31	3	0	0
delta-BHC	3.80	3.80	3.80	1	31	3	0	0
<u>Inorganics - Total (ug/L)</u>								
Aluminum	280.00	4141.60	17400.00	5	5	100	5	100
Antimony	1.90	5.40	8.90	2	5	40	0	0
Arsenic	5.80	17.44	29.60	5	5	100	4	80
Barium	27.80	154.06	332.00	5	5	100	0	0
Calcium	24400.00	86800.00	147000.00	5	5	100	0	0
Chromium	37.40	37.40	37.40	1	5	20	0	0
Cobalt	1.00	8.02	15.80	5	5	100	0	0

See last page for footnotes.



Table 5-17. Summary of Detected Concentrations of All Constituents in Groundwater Samples Collected During the Phase IA Remedial Investigation, Bayonne Plant, Bayonne, New Jersey.

Constituent	Minimum Quantifiable Concentration	Geometric Mean Quantifiable Concentration	Maximum Quantifiable Concentration	Number of Quantifiable Concentrations	Number of Samples Analyzed	Percent of Samples with Quantifiable Concentrations	Number of Samples Exceeding NJDEP Groundwater Quality Criteria	Percent of Samples Exceeding NJDEP Groundwater Quality Criteria
<u>Inorganics - Total (ug/L) (continued)</u>								
Copper	20.30	53.56	103.00	5	5	100	0	0
Cyanide	13.70	15.45	17.20	2	31	6	0	0
Iron	798.00	33212.15	148000.00	27	27	100	27	96
Lead	7.20	24.20	66.90	5	5	100	3	60
Magnesium	7190.00	18394.00	39500.00	5	5	100	0	0
Manganese	52.40	545.89	2490.00	27	27	100	27	96
Mercury	1.10	1.10	1.10	1	5	20	0	0
Nickel	11.60	21.93	33.80	4	5	80	0	0
Potassium	7080.00	42176.00	65600.00	5	5	100	0	0
Selenium	5.70	6.15	6.60	2	5	40	0	0
Sodium	14200.00	230440.00	545000.00	5	5	100	4	80
Vanadium	5.10	14.08	38.30	5	5	100	0	0
Zinc	30.80	102.30	161.00	5	5	100	0	0
<u>Inorganics - Dissolved (ug/L)</u>								
Aluminum	50.30	60908.88	512000.00	10	31	32	5	16
Antimony	121.00	144.67	162.00	3	31	10	3	10
Arsenic	2.80	408.58	2970.00	10	31	32	7	23
Barium	16.30	221.05	1780.00	26	31	84	0	0
Beryllium	110.00	132.33	158.00	3	31	10	4	13
Cadmium	124.00	148.33	175.00	3	31	10	3	10
Calcium	7280.00	122319.60	531000.00	25	31	81	0	0
Chromium	5.90	111.24	410.00	9	31	29	4	13
Cobalt	14.40	94.04	174.00	5	31	16	3	10
Copper	3.40	50.00	146.00	8	31	26	0	0
Hexavalent chromium	330.00	330.00	330.00	1	31	3	1	3
Iron	36.10	16635.17	182000.00	23	31	74	19	61
Lead	2.00	12.72	37.40	5	31	16	2	6
Magnesium	2590.00	66441.20	547000.00	25	31	81	0	0
Manganese	30.50	393.62	1170.00	24	31	77	21	68
Mercury	0.20	0.23	0.25	4	31	13	0	0
Molybdenum	17.60	24.58	31.10	6	31	19	0	0
Nickel	20.00	78.20	168.00	6	31	19	2	6
Palladium	20.10	20.10	20.10	1	31	3	0	0
Potassium	3550.00	21082.27	53500.00	22	31	71	0	0

See last page for footnotes.



Table 5-18. Summary of Field Parameter Measurements of Groundwater Samples Collected During the Phase IA Remedial Investigation at the Bayonne Plant, Bayonne, New Jersey.

Well Designation	Date	Temperature (°F)	Specific Conductance (umhos/cm)	pH (s.u.)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)
Phase IA Monitoring Wells						
<u>Shallow</u>						
GMMW2	1/25/95	56.12	1620	9.63	2.52	-252
GMMW3	1/25/95	62.81	998	6.23	4.11	-150
GMMW4	1/25/95	55.74	1409	6.66	1.52	25
GMMW6	1/25/95	55.34	744	7.06	4.66	-107
GMMW8	1/23/95	56.33	1100	7.84	9.08	195
GMMW9	1/23/95	54.50	1300	7.63	8.83	207
GMMW10	1/23/95	60.90	2254	6.55	2.04	-74
GMMW11 *	1/25/95	56.55	1028	8.61	1.12	1.0
GMMW13	1/27/95	51.33	284	6.39	2.8	-20
GMMW14	1/23/95	59.91	2122	6.94	1.08	-158
GMMW15	1/24/95	60.49	5240	6.82	1.17	-244
GMMW17	1/25/95	50.09	624	7.92	4.3	-72
GMMW19	1/27/95	54.33	234	6.67	3.09	101
GMMW20	1/23/95	55.79	9185	6.39	2.03	-54
<u>Intermediate</u>						
GMMW21I	1/26/95	58.10	3130	7.08	0.83	-50
GMMW23I	1/26/95	60.69	272	6.94	0.97	-64
GMMW24I *	1/26/95	60.13	**	6.23	0.64	-184
<u>Deep</u>						
GMMW21D	1/26/95	58.29	**	4.4	1.09	139
GMMW22D	1/27/95	60.40	3000	4.91	1.19	163
GMMW23D	1/26/95	61.26	4320	7.29	1.06	-81
GMMW24D	1/26/95	57.07	**	6.69	0.44	-174
Existing Monitoring Wells						
<u>Shallow</u>						
EB1	1/26/95	51.15	676	6.66	3.5	-30
EB29	1/26/95	44.49	165	6.15	11.73	421
EB51	1/25/95	55.07	7360	6.95	0.93	46
EB68	1/24/95	58.89	**	6.91	4.09	-259
EB90 *	1/27/95	51.45	926	6.97	0.8	300
EBR13 *	1/27/95	55.40	100	6.77	0.45	-133
EBR19	1/24/95	49.49	**	8.1	3.73	-171
MW 6	1/24/95	56.15	1107	6.42	1.82	-10
MW 9	1/24/95	55.77	659	6.23	5.72	-44
MW 10	1/23/95	52.62	1731	7.66	1.8	-109
PKMW4 *	1/27/95	55.65	9280	7.11	0.39	-164

NOTE: Unless otherwise noted, field parameter measurements were recorded downhole at the base of the water column after well purging and prior to groundwater sampling.

umhos/cm Micromhos per centimeter.

s.u. Standard unit.

mg/L Milligram per liter.

mV Millivolt.

* Value obtained prior to well purging.

** Value out of instrument range.

°F Degrees Fahrenheit.



Table 6-1. Physical and Chemical Properties of Organic Constituents of Concern, Bayonne, New Jersey.

Constituent	Molecular Weight (g/mol)	Water Solubility (mg/L 25 °C)	Specific Gravity	Vapor Pressure (mm Hg 25 °C)	Henry's Law Constant		Diffusivity (cm ² /sec)	Koc (mL/g)	Log Kow	Groundwater T ½		Soil T ½	
					(atm-m ³ /mol) (25 °C)					Low (days)	High (days)	Low (days)	High (days)
VOCs													
Acetone	58	miscible	0.79	2.7E+02	3.97E-05	0.11498		0.37	-0.24	2 -	14	1 -	7
Benzene	78	1,780	0.88	9.5E+01	5.48E-03	0.09320		49 - 100	1.56 - 2.15	10 -	720	5 -	16
2-Butanone	72	239,000	0.80	1.0E+02	4.66E-05	0.08944		1.2	0.26 - 0.29	2 -	14	1 -	7
Chlorobenzene	113	295 - 500	1.1	1.2E+01	4.45E-03	0.07193		48 - 331	2.71 - 2.98	136 -	300	68 -	150
Chloroform	119	7,222 - 9,600	1.48	2.0E+02	3.20E-03	0.08868		44	1.90 - 1.97	56 -	1,825	28 -	180
Dichlorobromomethane	164	4,700	1.99	5.0E+01 (20 °C)	2.12E-04	0.08966		62	1.88	ND		ND	
cis-1,2-Dichloroethene	97	3,500	1.28	2.0E+02	3.37E-03	0.09980		49	1.86	56 -	2,850	28 -	180
trans-1,2-Dichloroethene	97	6,300	1.25	2.7E+02 (20 °C)	6.74E-03	0.09980		59	2.09	56 -	2,850	28 -	180
Ethylbenzene	106	152 - 208	0.87	9.5E+00	8.68E-03	0.06667		95 - 260	3.05 - 3.15	6 -	228	3 -	10
Methylene chloride	85	13,000 - 16,700	1.32	4.4E+02 - 4.6E+02	2.69E-03	0.08500		8.7	1.25 - 1.30	14 -	56	7 -	28
Tetrachloroethene	166	150 - 485	1.6	1.9E+01	2.87E-03	0.07404		210 - 363	2.1 - 2.88	360 -	730	180 -	365
Trichloroethene	131	1,100 - 1,500	1.46	7.3E+01	9.90E-03	0.08116		65 - 126	2.29 - 3.30	321 -	1,643	180 -	365
Vinyl chloride	63	1,100 - 2,700	0.91	2.7E+03	5.60E-02	0.10726		2.5	0.60	56 -	2,850	28 -	180
Xylenes (total)	106	162 - 200	0.87	6.6E+00 - 8.8E+00	6.30E-03	0.07164		128 - 1,580	2.77 - 3.20	14 -	360	7 -	28
Semi-VOCs													
Benzo(a)anthracene	228	0.0094 - 0.014	1.27	1.1E-07	8.00E-06	0.04564		1,400,000	5.61 - 5.91	204 -	1,361	102 -	679
Benzo(b)fluoranthene	252	0.0012	ND	5.0E-07	1.20E-05	0.04392		550,000	6.57	719.1 -	1,219	360 -	610
Benzo(k)fluoranthene	252	0.00055	ND	9.6E-11	1.04E-03	0.04392		4,400,000	6.85	1,821 -	4,271	909 -	2,139
Benzo(a)pyrene	252	0.0038 - 0.004	1.35	5.5E-09	2.40E-06	0.04653		398,000 - 1,900,000	5.81 - 6.50	114 -	1,059	57 -	529
Chrysene	228	0.0018 - 0.006	1.27	6.3E-09	3.15E-07	0.04531		240,000	5.60 - 5.91	744.6 -	2,000	372 -	993
Dibenzo(a,h)anthracene	278	0.00249 - 0.005	1.28	10E-10 (20 °C)	7.33E-09	0.05707		1,700,000	5.97 - 6.50	722.7 -	1,880	361 -	942
1,2-Dichlorobenzene	147	92.7 - 156	1.3	1.5E+00	2.40E-03	0.07113		180 - 1,700	3.38 - 3.55	56 -	360	28 -	180
1,4-Dichlorobenzene	147	65.3 - 90.6	1.25	4.0E-01	4.45E-03	0.07134		158	3.37 - 3.62	56 -	360	28 -	180
2,4-Dimethylphenol	122	7,868	0.96	9.8E-02	6.55E-06	0.06938		117	2.4	2 -	14	1 -	7
Indeno(1,2,3-c,d)pyrene	276	0.062	ND	1.0E-09	2.96E-20	0.05728		31,000,000	5.91 - 7.70	1,201 -	1,460	599 -	730
2-Methylnaphthalene	142	25	1.00	4.5E-02	3.36E-04	0.06196		7,400 - 8,500	3.86 - 4.11	ND		ND	
Naphthalene	128	30 - 34	1.16	2.3E-01 - 8.7E-01	4.60E-04	0.08205		550 - 3,160	3.2 - 4.7	1 -	258	16.6 -	48
N-Nitrosodiphenylamine	198	35.1	ND	1.0E-01	2.33E-08	0.06710		575	3.13	20 -	68	10 -	34
Pentachlorophenol	266	20 - 25	1.98	1.7E-05	3.40E-06	0.05528		891	5.01 - 5.86	46 -	1533	23 -	178
Pyrene	202	0.013 - 0.171	1.27	6.85E-07 - 2.5E-06	1.10E-05	0.05039		46,000 - 135,000	4.88 - 5.32	420 -	3,796	210 -	1,898
Pesticides													
alpha-BHC	291	2.0	1.87	2.5E-05 (20 °C)	5.30E-06	0.05198		1,901	3.46 - 3.89	13.8 -	270	13.8 -	135
4,4'-DDD	320	0.02 - 0.16	1.48	1.02E-6 (30 °C)	2.16E-05	0.04742		44,000 - 80,500	5.99	70 -	11,425	730 -	5,694
4,4'-DDT	354	0.0012 - 0.26	1.56	1.9E-07	5.20E-05	0.04467		140,000 - 1,800,000	4.89 - 6.44	16 -	11,425	2 -	5,694
Dieldrin	381	0.195	1.75	1.8E-07	5.80E-05	0.04875		12,000 - 35,000	3.69 - 5.48	1 -	2,190	175 -	1,095

References: Hazardous Substances Databank, 1993; Howard et al., 1991; Howard, 1990 and 1989; Lugg, 1968; Lyman et al., 1990; Montgomery and Welton, 1990; Shen, 1982; and Verschueren, 1983.

atm-m³/mol
°C
cm²/sec
g/mol
Koc
Kow

Atmospheres-cubic meters per mole.
Degrees Celsius.
Square centimeters per second.
Grams per mole.
Organic carbon partition coefficient.
Octanol-water partition coefficient.

mg/L
mL/g
mm Hg
ND
T ½

Milligrams per liter.
Milliliters per gram.
Millimeters of mercury.
No data.
Half-life.



Table 7-1. Summary of RI Analytical Findings and NAPL Observations by Area, Bayonne Plant, Bayonne, New Jersey.

Area	Soil Surface (0- to 2-feet below grade) Exceedances ¹	Subsurface (greater than 2-feet below grade) Exceedances ¹	NAPL * Plume No. (see Table 5-10)	Groundwater ^{2 **} Exceedances [b]
Piers and East Side Treatment Plant Area, and MDC Building Area	NA	TPH	1, 2, 3	VOC: 2-Butanone, Benzene, Bromodichloromethane, Chlorobenzene, Chloroform, Xylenes (total); Al, Be, Cd, Co, Cr Fe, Mn, Na, Ni, Sb, V, Cl, SO ₄
Low Sulfur and Solvent Tank Fields	TPH, As, Cu	TPH, SVOC: Benzo(a)pyrene, Naphthalene	4	TPH, VOC: Benzene, Ethylbenzene, Xylenes (total), 1,2-Dichloroethane (total), Vinyl chloride; SVOC: 2,4-Dimethylphenol, 2-Methylnaphthalene, naphthalene; Al, As, Be, Cd, Co, Cr, Fe, Mn, Na, Pb, V, Cl
General Tank Field	TPH, SVOC: Benzo(a)pyrene; As, Be, Cu, Pb, Zn,	TPH, VOC: Xylenes (Total), SVOC: Benzo(a)pyrene; As, Cu, Pb, Zn	5, 6	TPH, VOC: Benzene; Al, Fe, Mn, Na, Cl
AV-Gas Tank Field and Domestic Trade Area(Includes Southern Part of Interceptor Trench)	TPH, SVOC: Dibenz(a,h)anthracene Benzo(a)pyrene; As, Be, Pb	TPH, SVOC: Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene; As, Pb, Ti	7	TPH, Mn, Na
Asphalt Plant and Chemicals Plant (Includes Utility Area)	TPH, SVOC: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene; As, Cu	TPH, VOC: Chlorobenzene, Xylenes (Total); SVOC: Benzo(a)pyrene, Dibenz(a,h)anthracene, 1,2-Dichlorobenzene, 1,4-Dichlorobenzene, Naphthalene; As, Pb, Ti	8, 9	TPH, VOC: Benzene, Chlorobenzene, Chloroform; SVOC: 1,4-Dichlorobenzene, Naphthalene; As, Fe, Mn, Na, Cl, SO ₄
No. 3 Tank Field	TPH, VOC: Benzene, Chlorobenzene, Xylenes (total); SVOC: Benzo(a)pyrene, Dibenz(a,h)anthracene, n-Nitrosodiphenylamine, As, Be, Pb, Cr ⁺ ⁸	TPH, VOC: Chlorobenzene, Benzo(a)anthracene; SVOC: Benzo(a)pyrene; As, Cu, Ni	10	TPH, VOC: Benzene, Chlorobenzene; Pest/PCB: 4,4'-DDT As, Cr, Fe, Mn, Na

See last page for footnotes.



Table 7-1. Summary of RI Analytical Findings and NAPL Observations by Area, Bayonne Plant, Bayonne, New Jersey.

Area	Soil Surface (0- to 2-feet below grade) Exceedances ¹	Subsurface (greater than 2-feet below grade) Exceedances ¹	NAPL * Plume No. (see Table 5-10)	Groundwater ^{2 **} Exceedances [b]
No. 2 Tank Field and Main Building Area (Includes Northern Part of Interceptor Trench)	TPH, As	TPH, VOC: Xylenes (Total); SVOC: Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene; As, Cu, Pb, Ti, Cr ⁺⁶	11, 12	TPH, VOC: Benzene, Xylenes (total), Methylene chloride; SVOC: 2-Methylnaphthalene, Naphthalene; Al, As, Fe, Na, V
"A"-Hill Tank Field	TPH, As	TPH, As	13	TPH, Pb, Mn
Lube Oil Area and Stockpile Area (Includes Platty Kill)	TPH, SVOC: Dibenzo(a,h)anthracene, Benzo(a)pyrene; Pest/PCB, As, Pb	TPH, SVOC: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(l)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Pyrene; As, Pb, Ti	14, 15, 18	TPH, VOC: Benzene, Bromodichloromethane, Chloroform; As, Fe, Mn, Na, Cl, SO ₄
Pier No. 1 Area (Includes Helipad)	NA	TPH, SVOC: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(a)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene; As	17	TPH, VOC: 1,2-Dichloroethene (total), Acetone, Benzene, Tetrachloroethene, Trichloroethene, Vinyl chloride; SVOC: Pentachlorophenol; Pest/PCB; alpha-BHC; Al, Fe, Mn, Na, SO ₄

See last page for footnotes.



Table 7-1. Summary of RI Analytical Findings and NAPL Observations by Area, Bayonne Plant, Bayonne, New Jersey.

ft	Feet.
*	NAPL plumes as enumerated on Figure 5-5.
**	Metal exceedances are for dissolved metals only.
NAPL	Non-aqueous phase liquid.
1	Soil constituents listed are detected in concentrations either above the NJDEP non-residential direct contact soil cleanup criteria or impact to groundwater criteria.
2	Groundwater constituents listed are detected in concentrations either above the New Jersey Department of Environmental Protection (NJDEP) groundwater quality standards or above the interim generic groundwater quality criteria (IGGWQC) established for the Bayway Refinery.
TPH	Total petroleum hydrocarbons - detected in soil by Method 418.10 (NJ modified) above 10,000 mg/kg) or in groundwater above 1 mg/L.
NA	Area not analyzed during the RI; these areas have undergone extensive IRM investigations.
Al	Aluminum
As	Arsenic
Be	Beryllium
Cd	Cadmium
Co	Cobalt
Cr	Chromium
Cu	Copper
Fe	Iron
Mn	Manganese
Na	Sodium
Ni	Nickel
Pb	Lead
Tl	Thallium
V	Vanadium
Cl	Chlorides
SO ₄	Sulfate
Cr ₆	Hexavalent Chromium
VOC	Volatile Organic Compound
SVOC	Semivolatile Organic Compound
Pest/PCB	Pesticide and Polychlorinated Biphenyl

